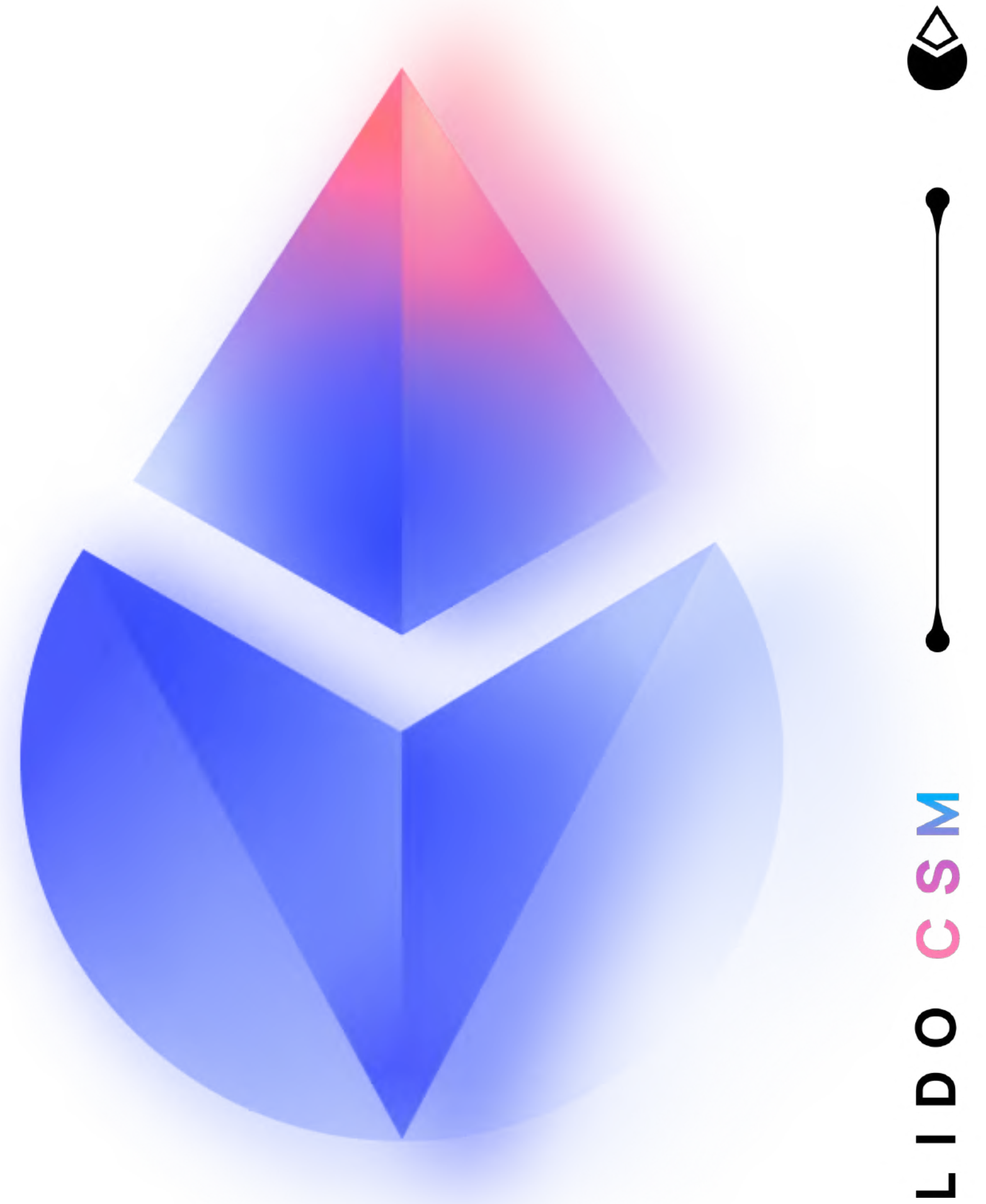


Ethereum validation



IN A NUTSHELL

Try Pitch



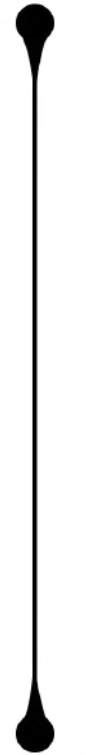
Dmitry Gusakov

@dggusakov

Contributing to Lido
DAO
since early 2022

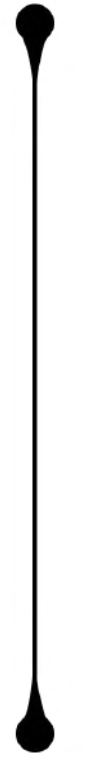
Making Lido
permissionless
since 2023

Try Pitch



LIDO CSM

How to validate ETH?

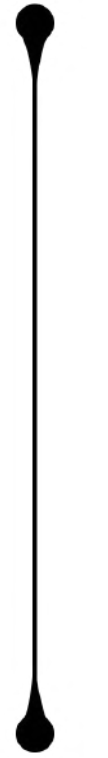
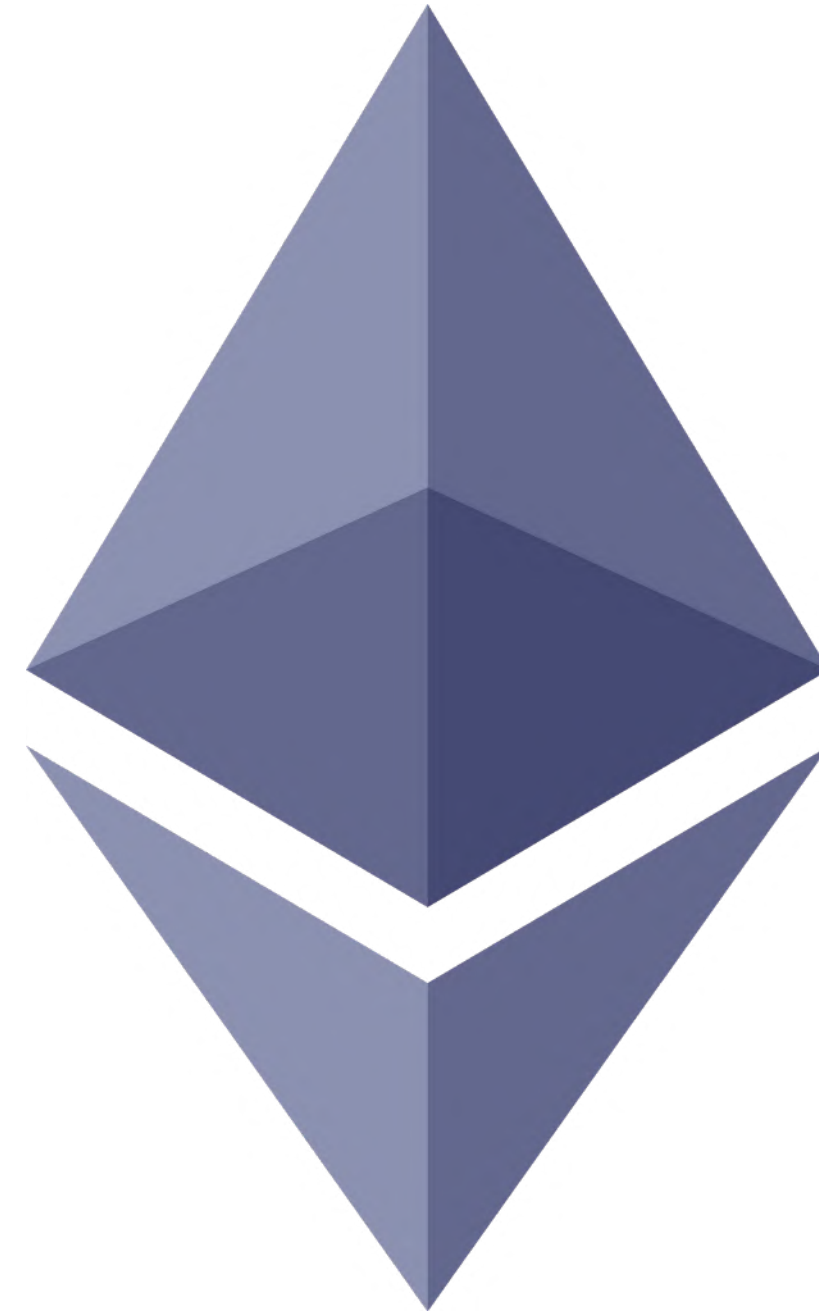


LIDO CSM

Ethereum



Vitalik Buterin



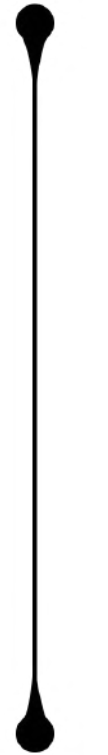
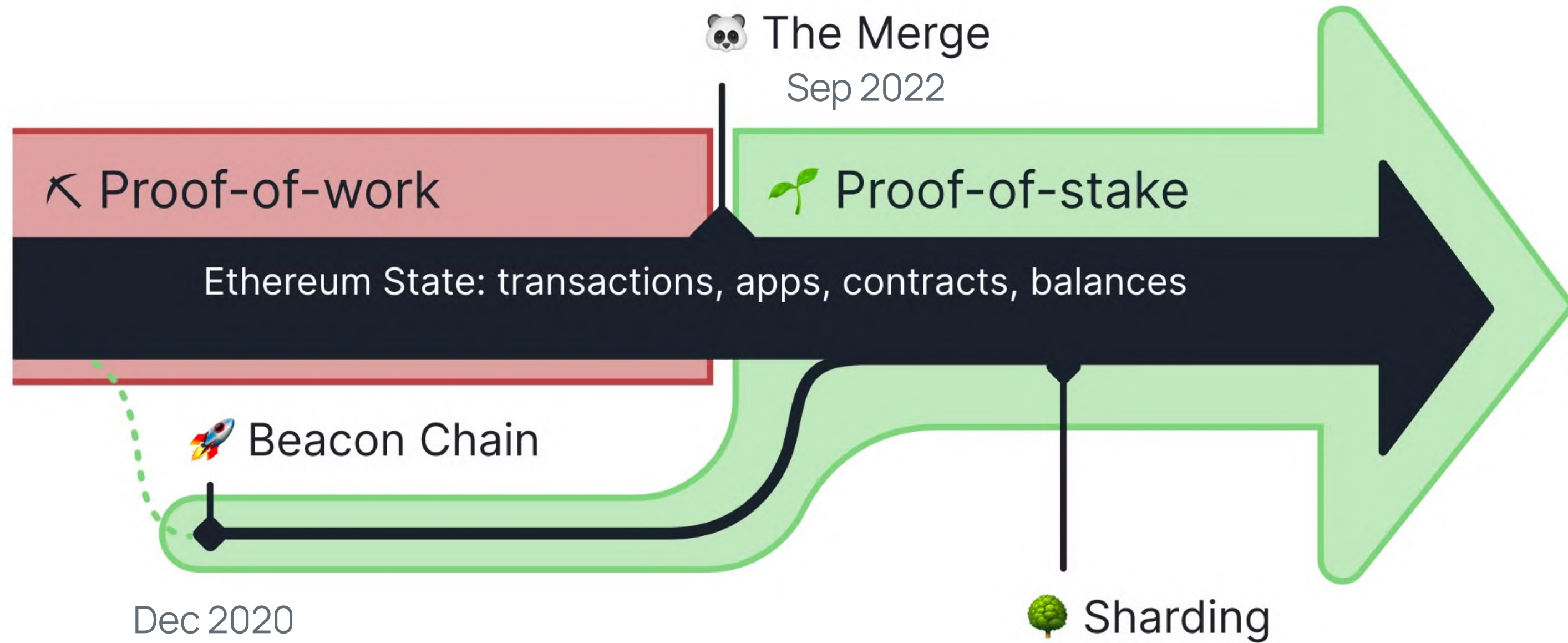
LIDO CSM

Ethereum



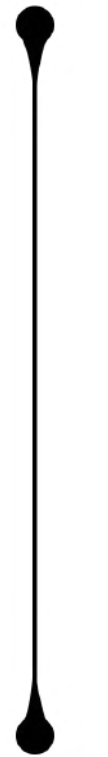
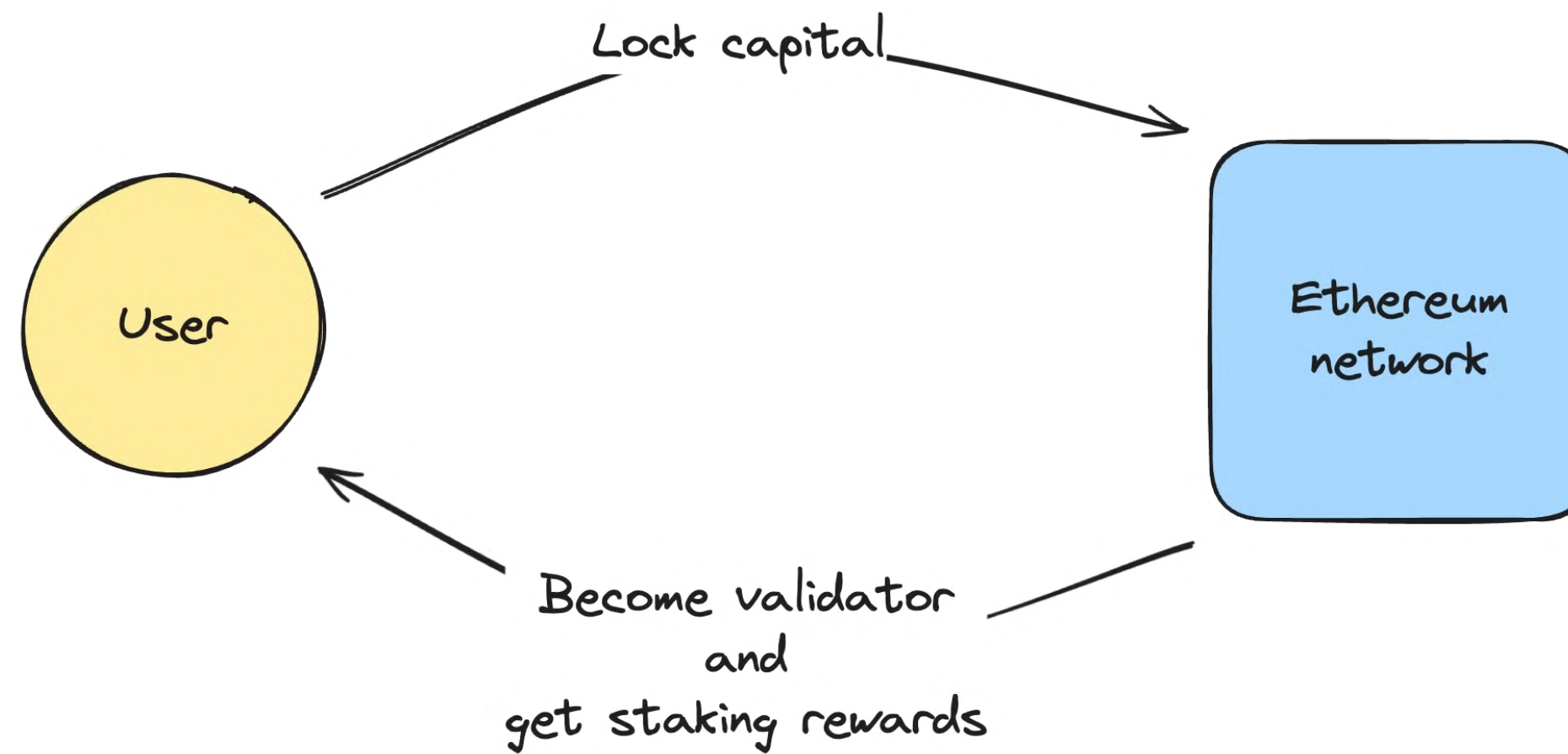
L I D O C S M

Ethereum



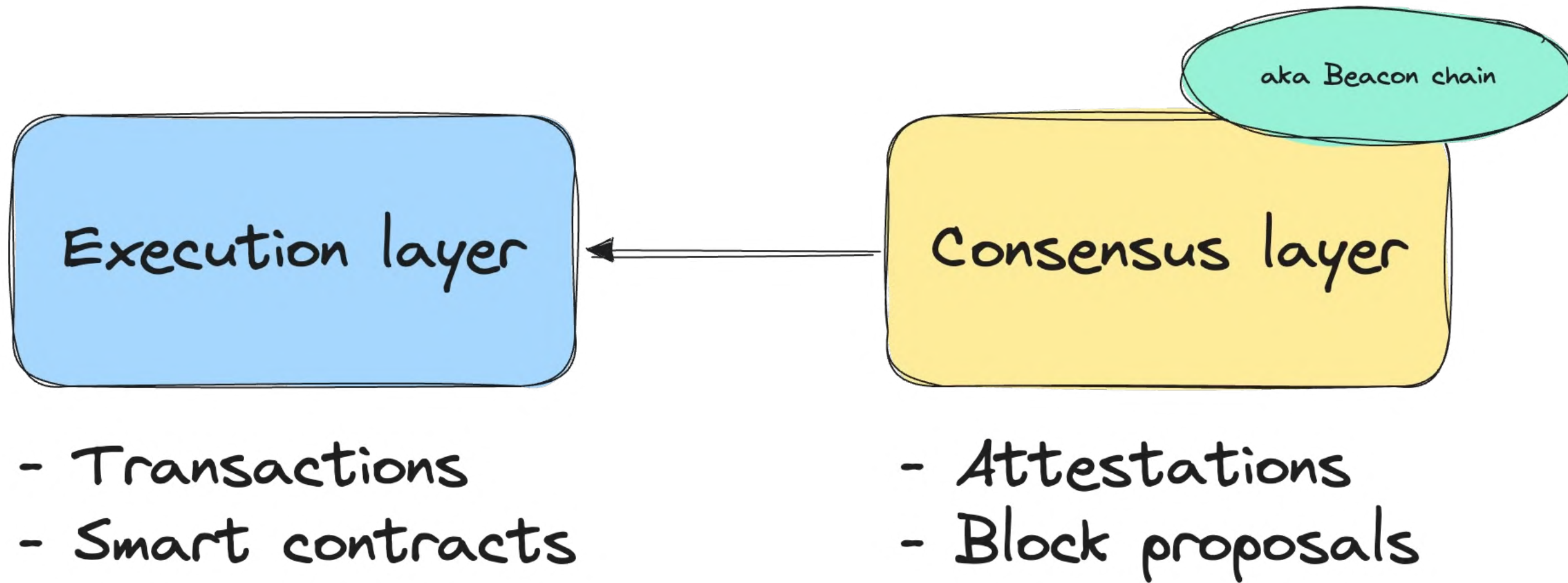
L I D O C S M

Ethereum Staking

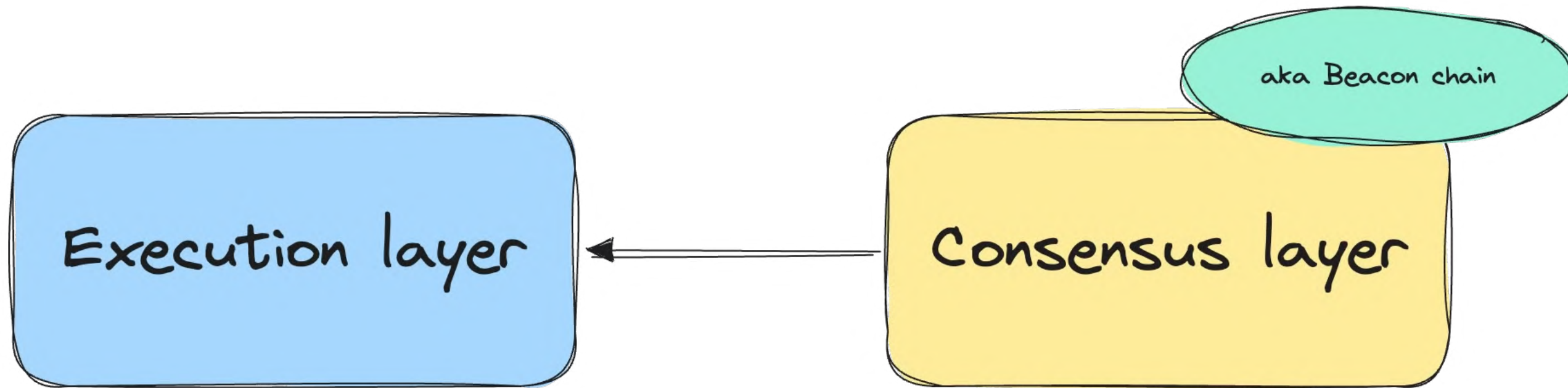


LIDO CSM

Ethereum Network



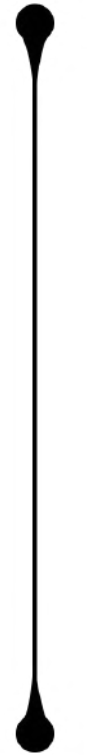
Ethereum Network



- Transactions
- Smart contracts

- Attestations
- Block proposals

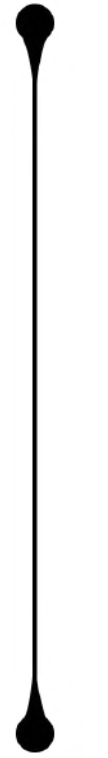
Validators operate here



LIDO CSM

Ethereum Consensus

Gasper



LIDO CSM

Ethereum Consensus

Gasper



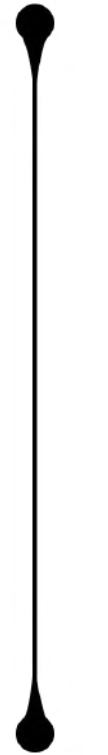
LMD Ghost

Latest Message Driven

Greedy Heaviest-Observed Sub-Tree

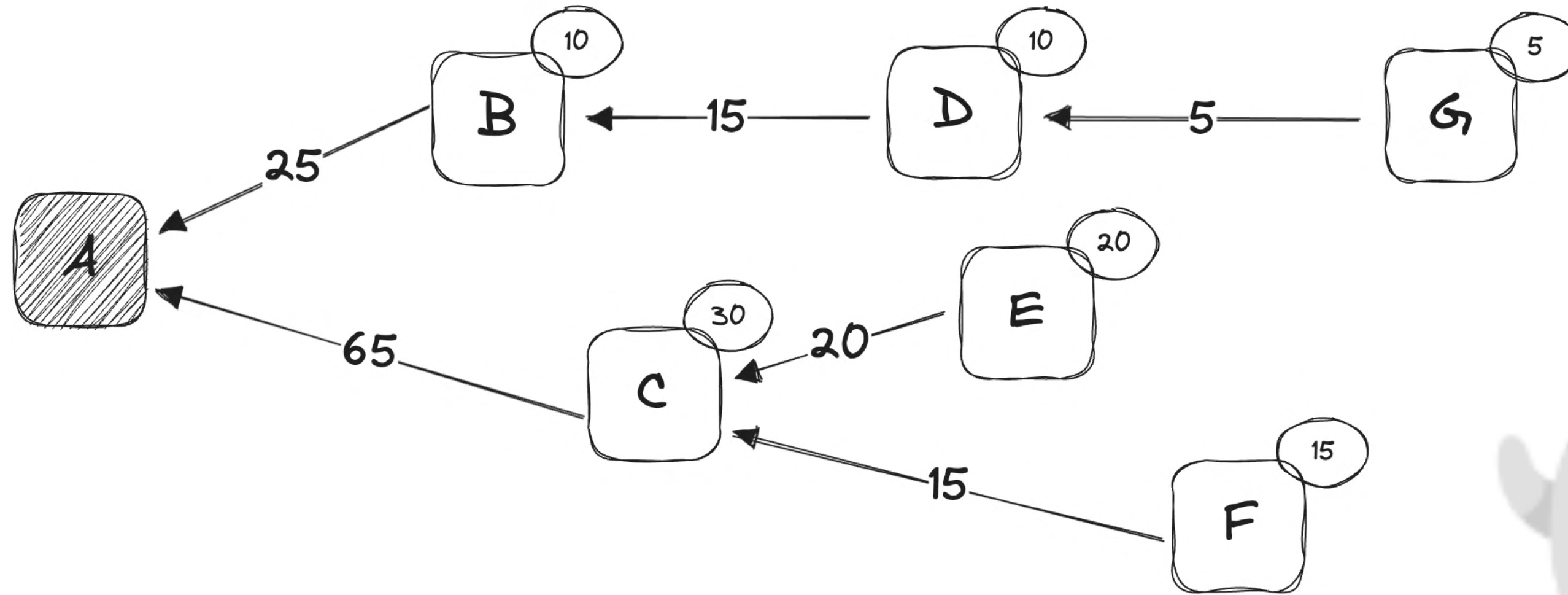
Casper FFG

Casper Friendly Finality Gadget

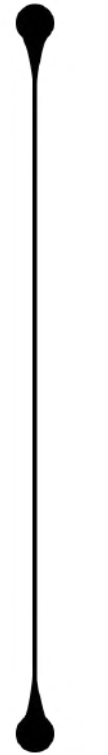


LIDO
CSM

Ethereum Fork choice

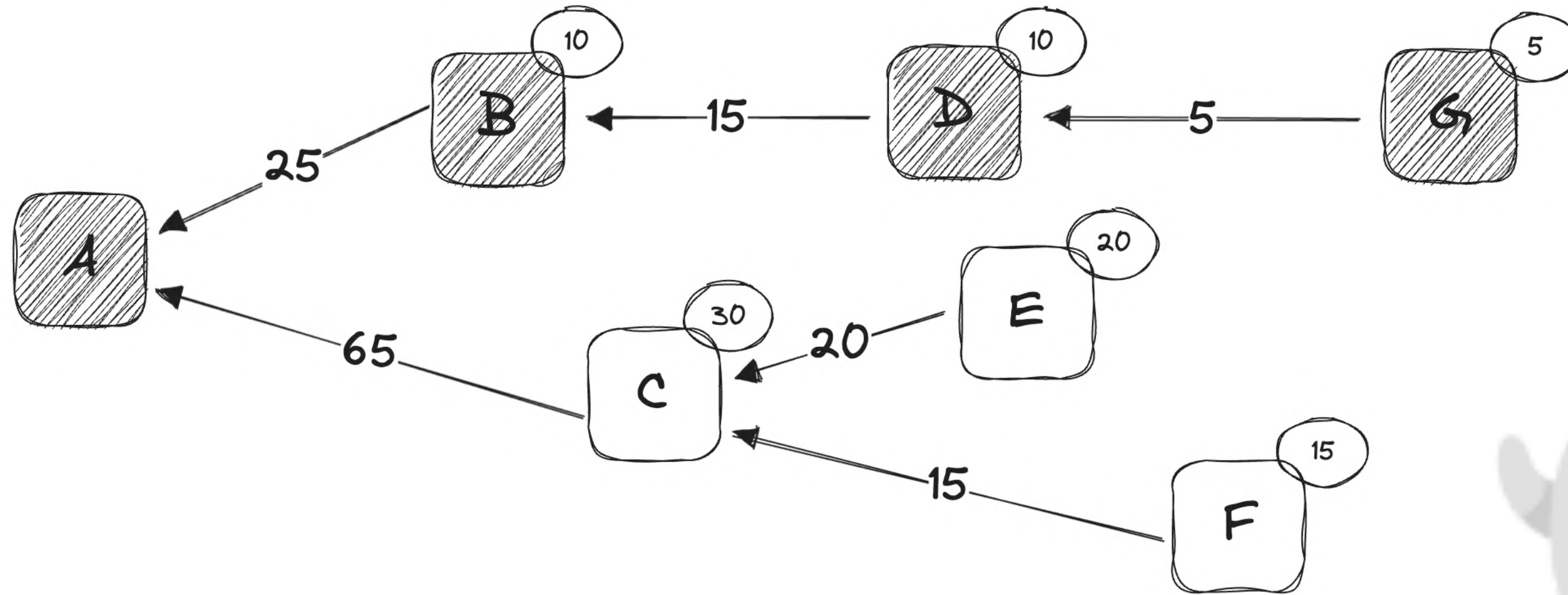


Latest Message Driven
Greedy Heaviest-Observed Sub-Tree

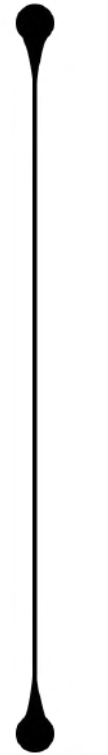


L I D O C S M

Ethereum Fork choice

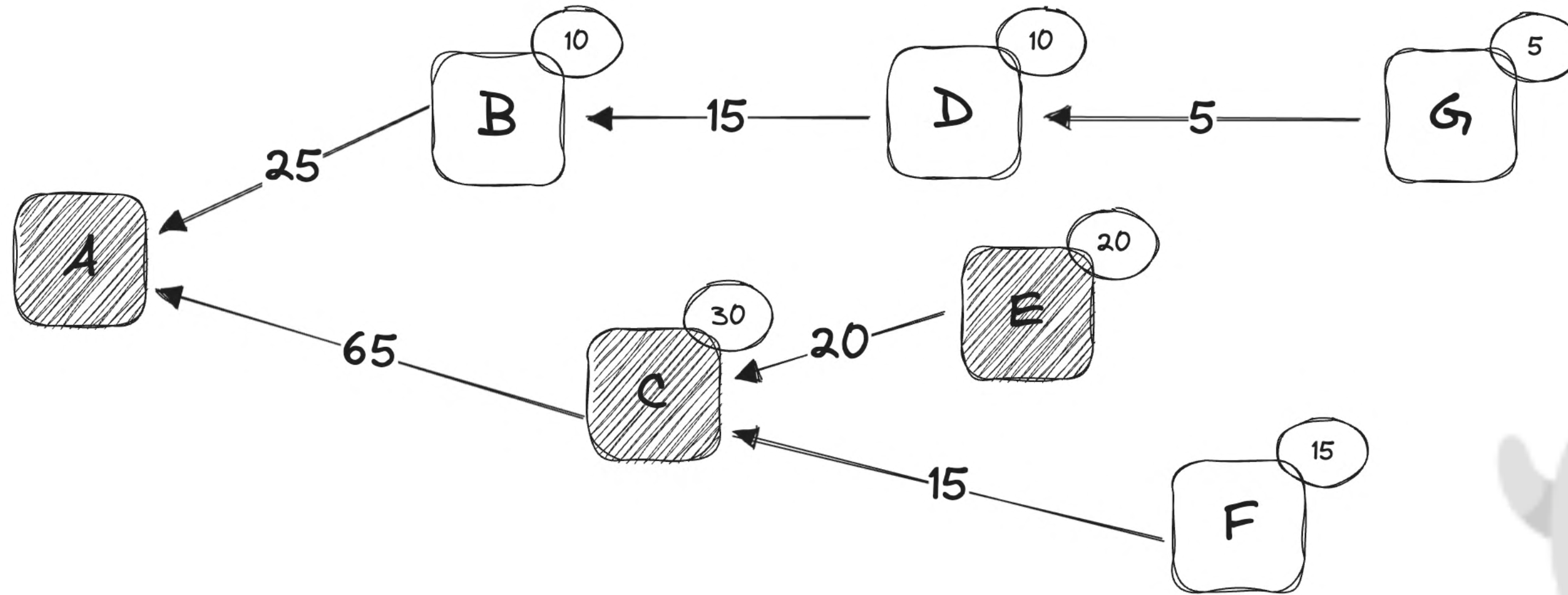


Latest Message Driven
Greedy Heaviest-Observed Sub-Tree

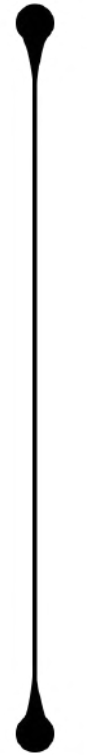


LIDO CSM

Ethereum Fork choice



Latest Message Driven
Greedy Heaviest-Observed Sub-Tree

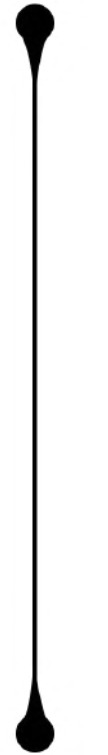


L I D O C S M

Ethereum Finality

Finalized block and all his ancestors
can never be changed or reorged

Casper Friendly Finality Gadget



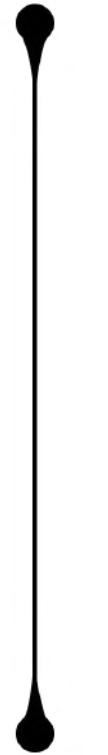
LIDO CSM

Ethereum Finality

Finalized block and all his ancestors
can never be changed or reorged

Network finality is not guaranteed!

Casper Friendly Finality Gadget



LIDO CSM

Ethereum Consensus

Gasper



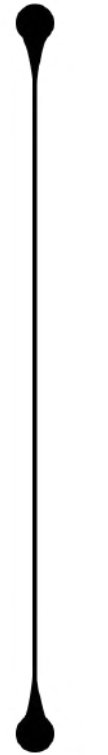
LMD Ghost

Latest Message Driven

Greedy Heaviest-Observed Sub-Tree

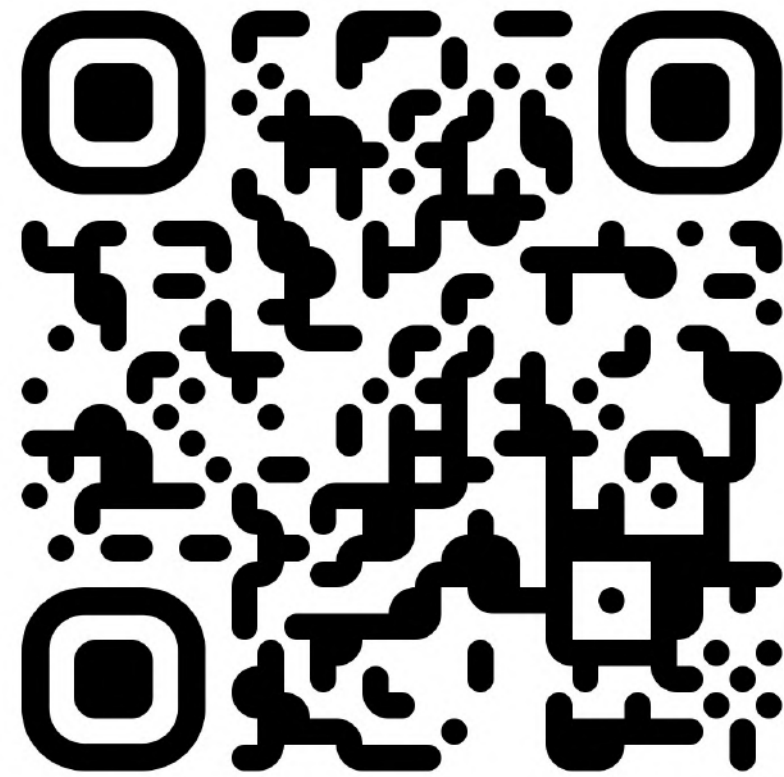
Casper FFG

Casper Friendly Finality Gadget

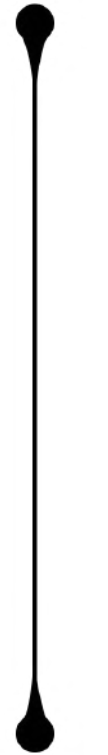


LIDO
CSM

Ethereum Consensus

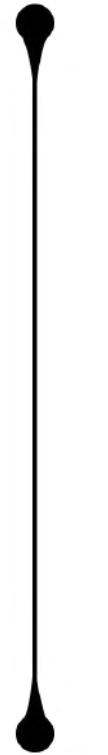
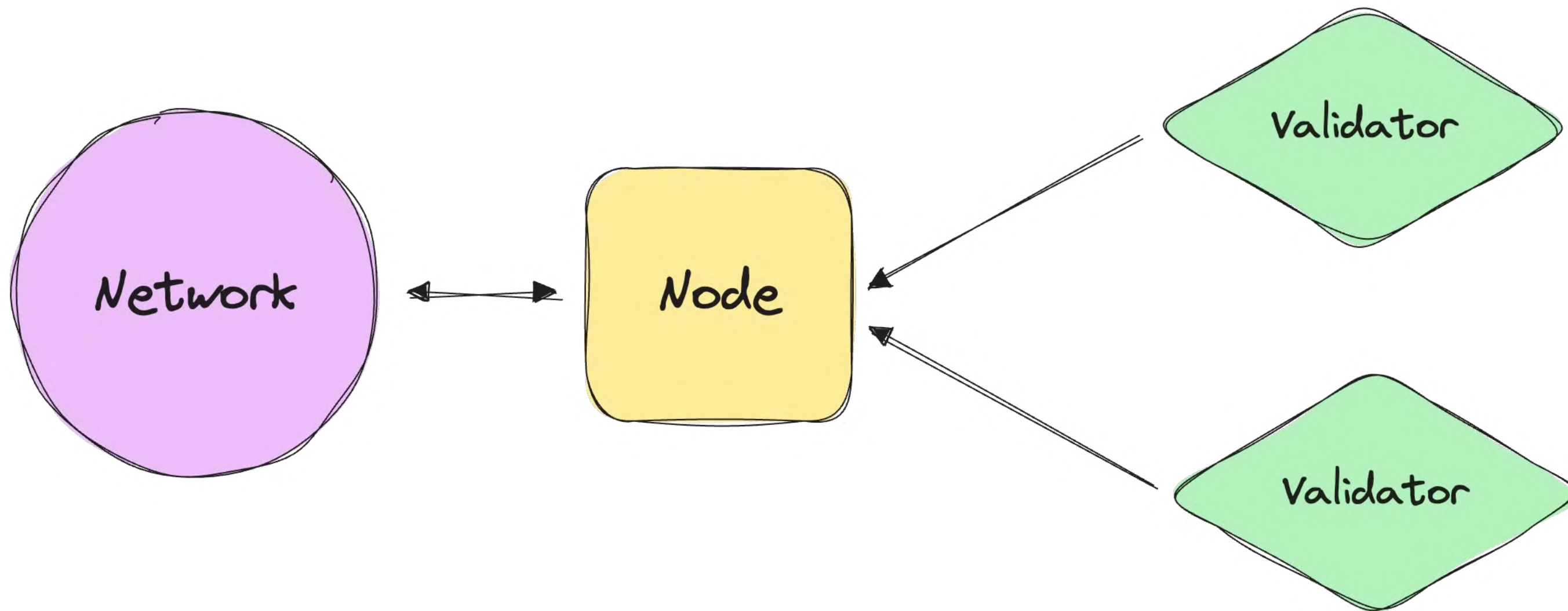


eth2book
by Ben Edgington

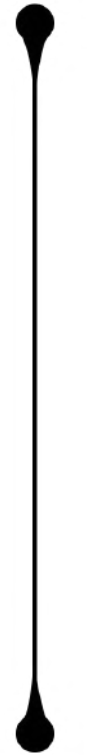
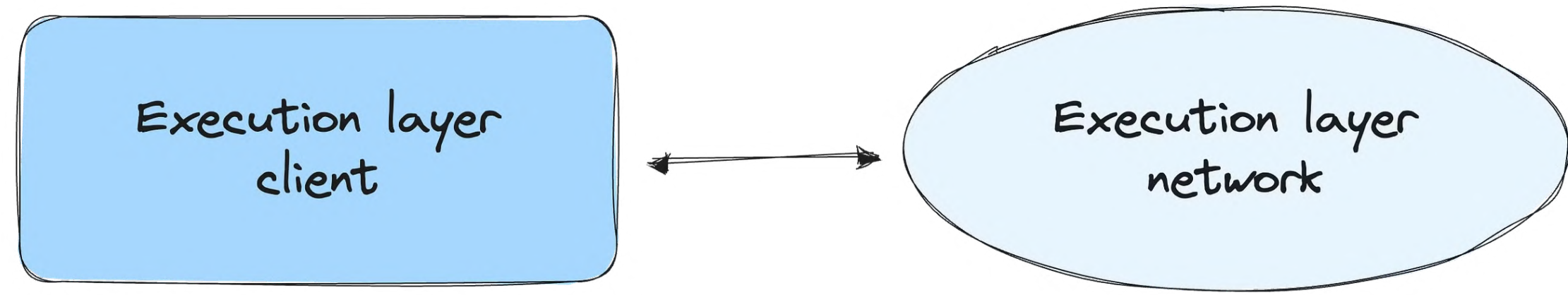


LIDO CSM

Nodes and Validators

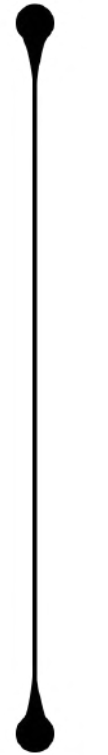
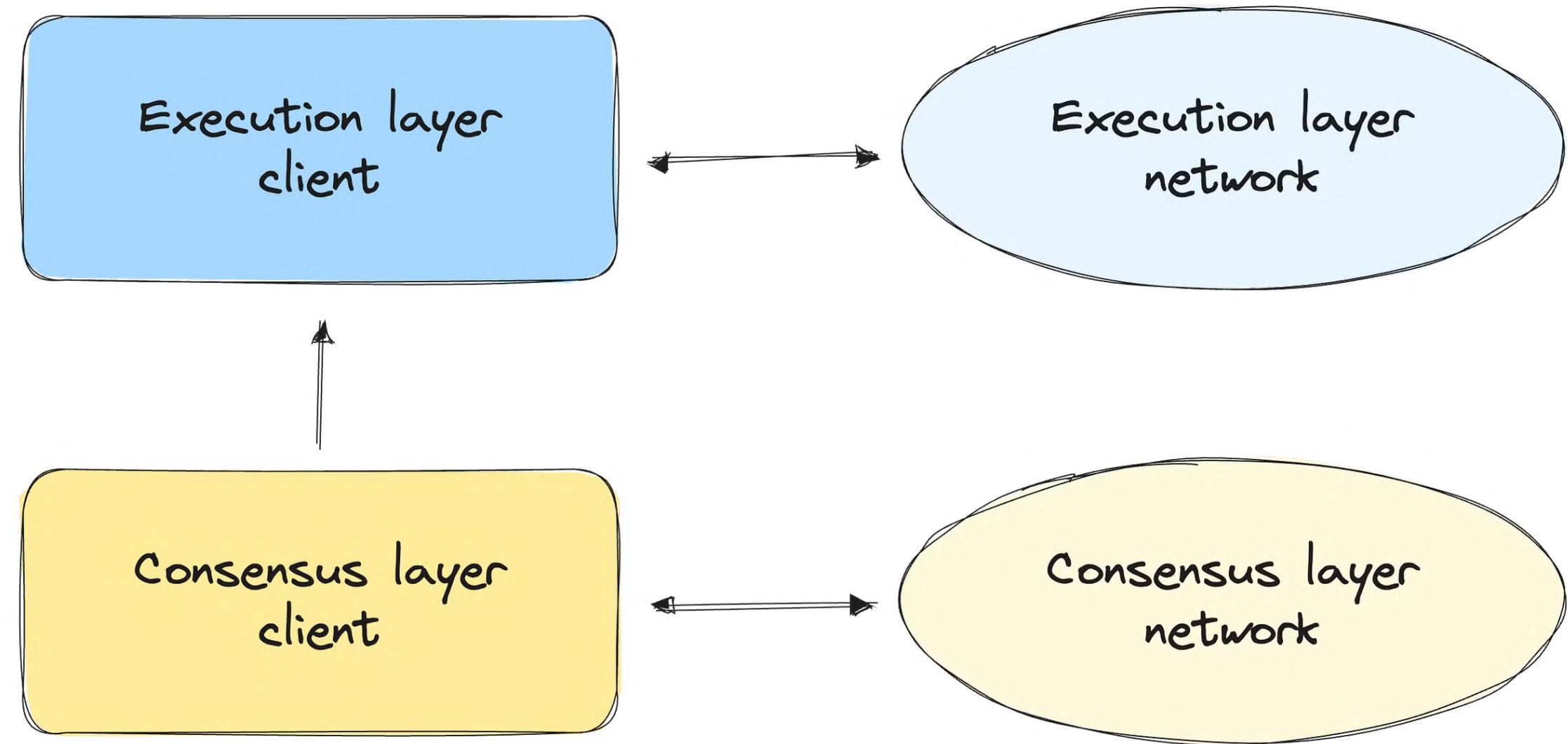


Nodes and Validators



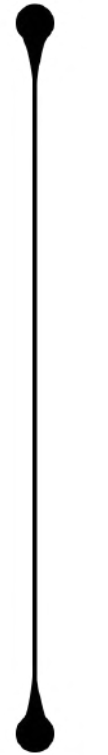
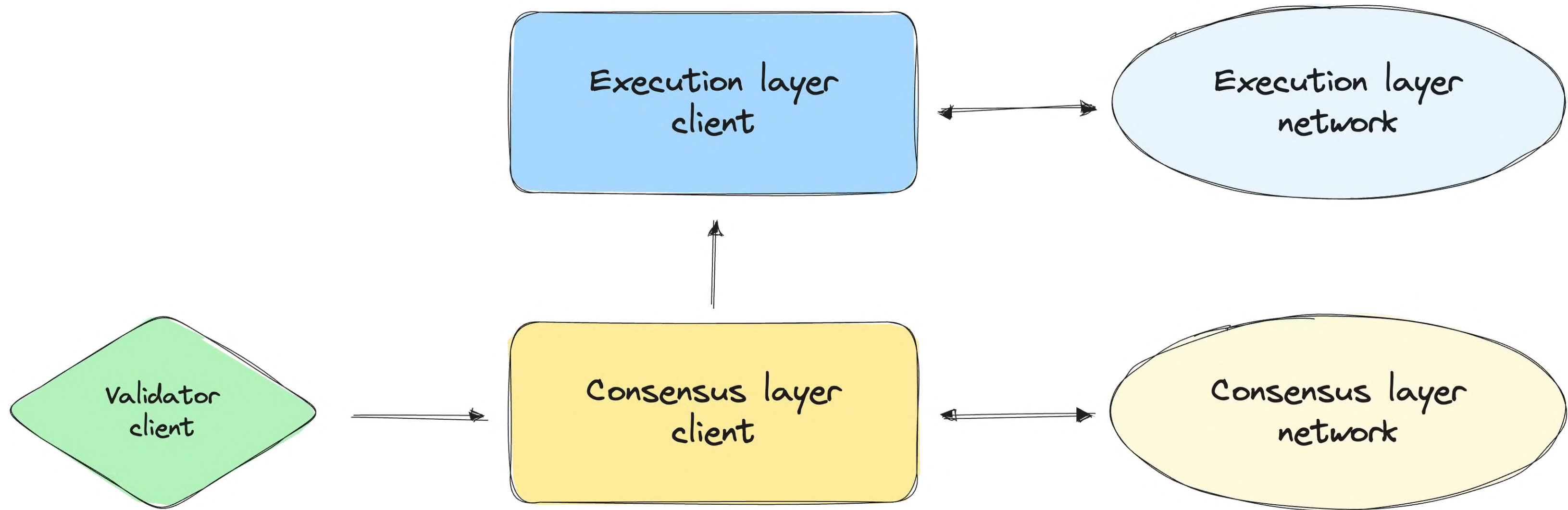
LIDO CSM

Nodes and Validators



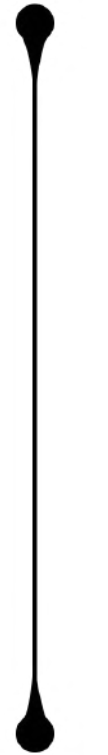
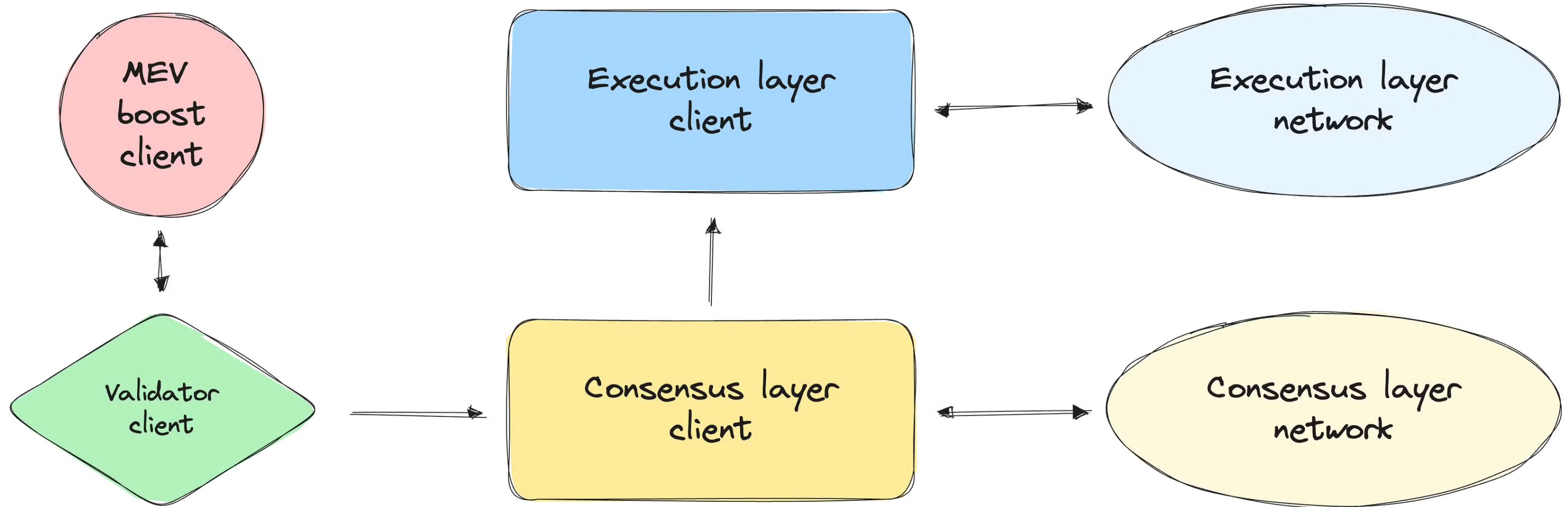
LIDO CSM

Nodes and Validators



LIDO CSM

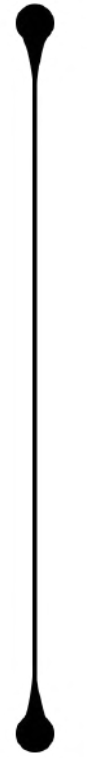
Nodes and Validators



LIDO CSM

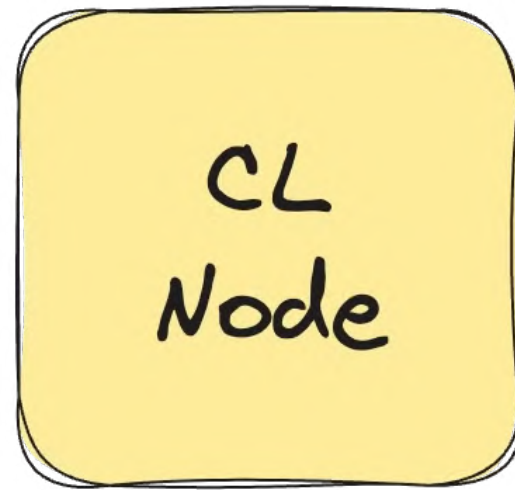
Nodes and Validators

"Validator" is the most misleading term in Ethereum!

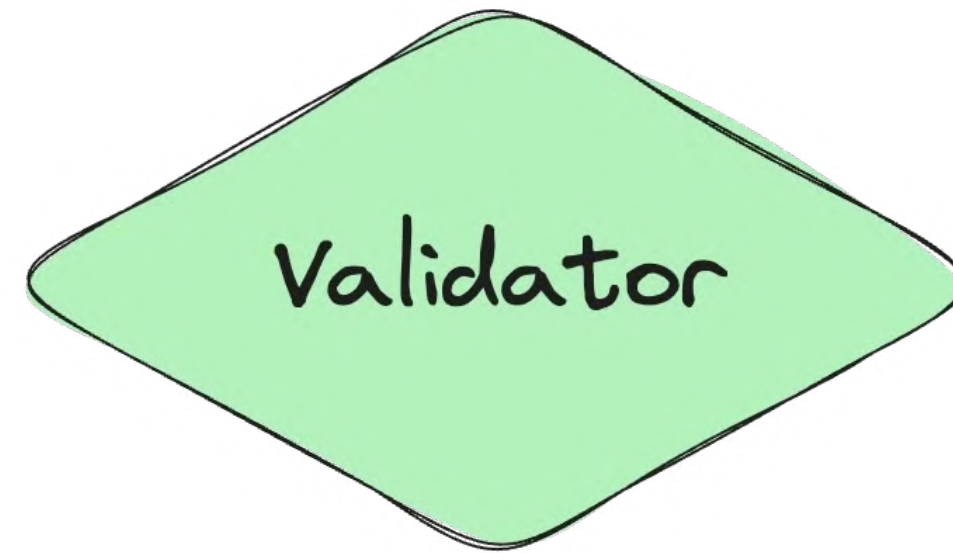


LIDO CSM

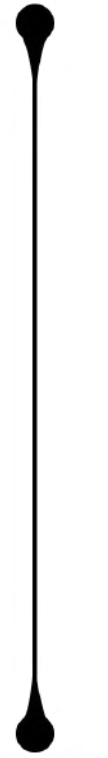
Nodes and Validators



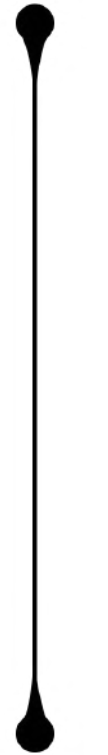
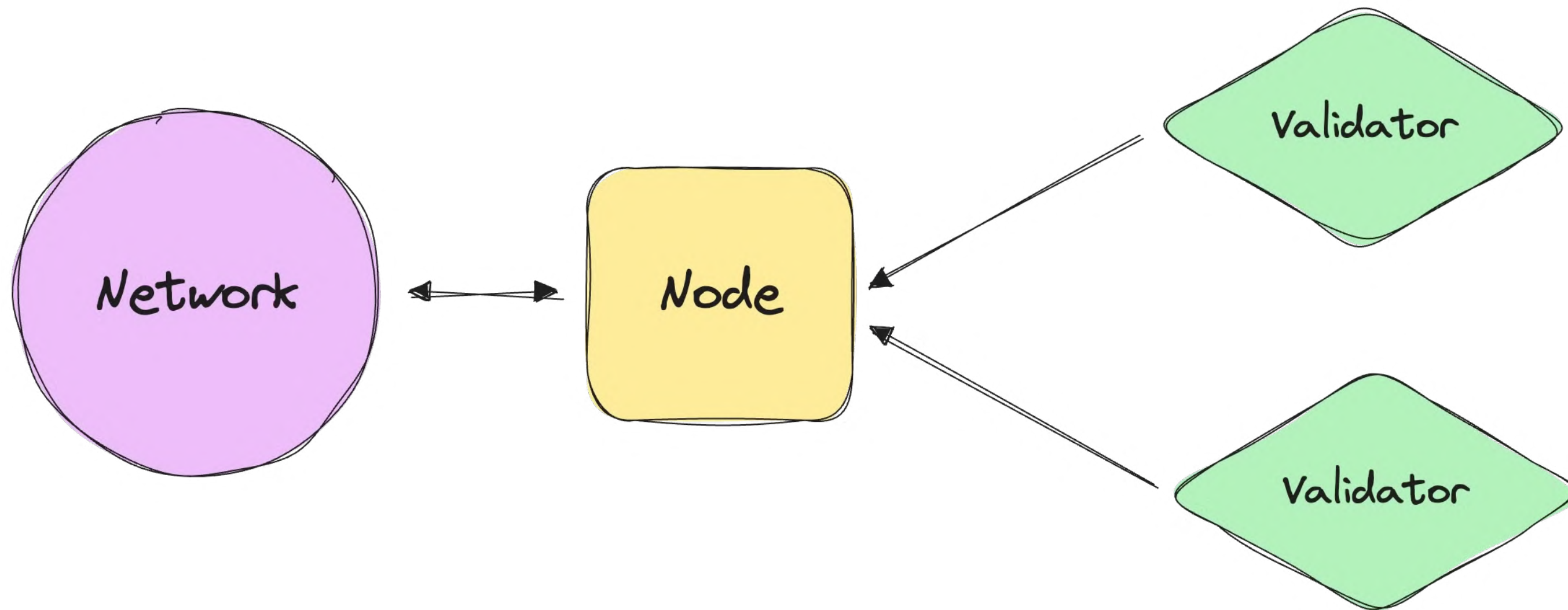
- Validate blocks
- Select fork
- Communicate with the network



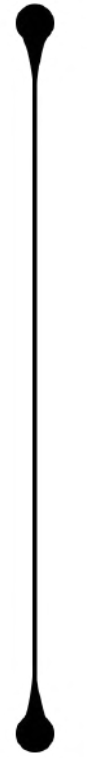
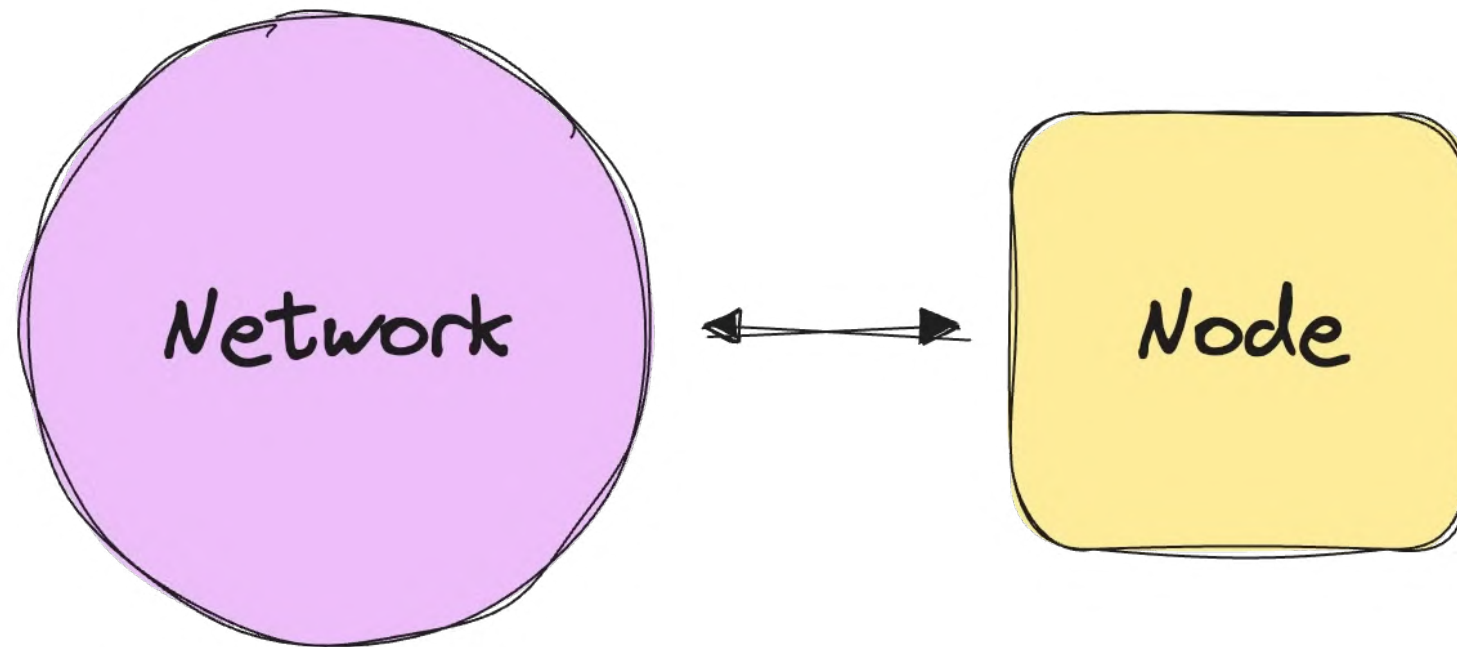
- Propose blocks
- Attest chain state
- Report slashings



Nodes and Validators

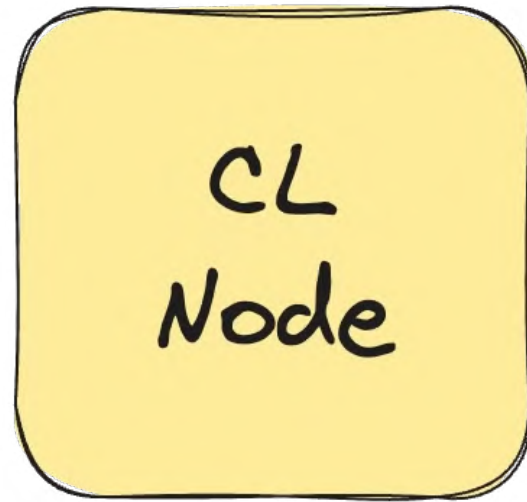


Nodes and Validators

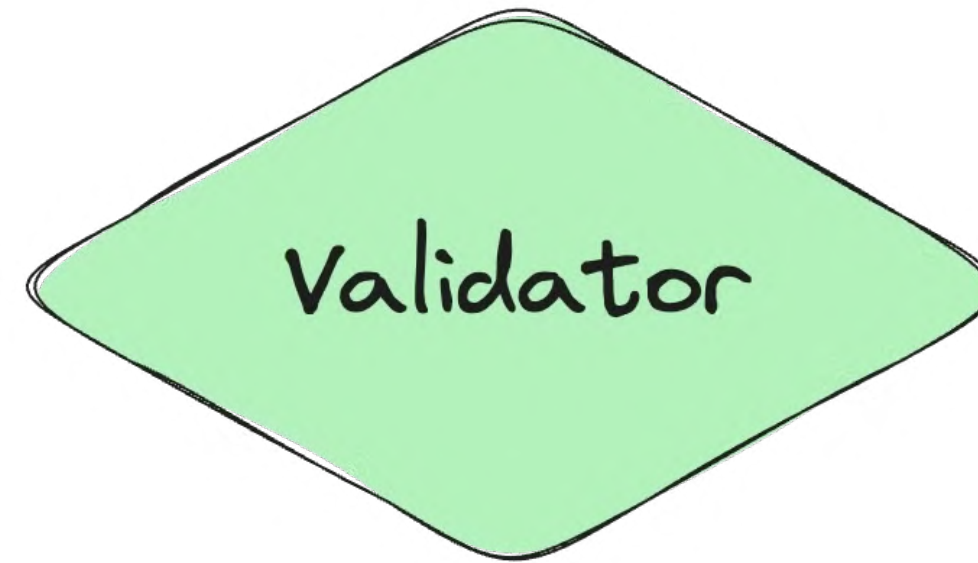


LIDO CSM

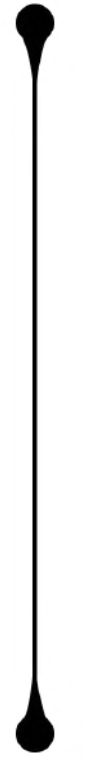
Nodes and Validators



No deposit
required



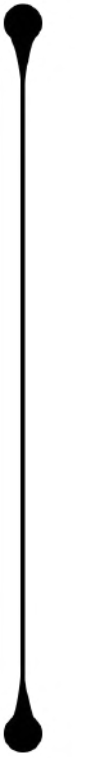
32 ETH deposit
per instance



LIDO CSM

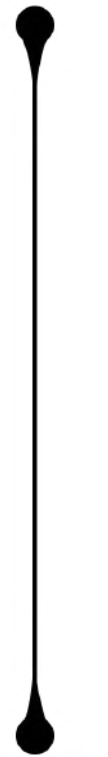
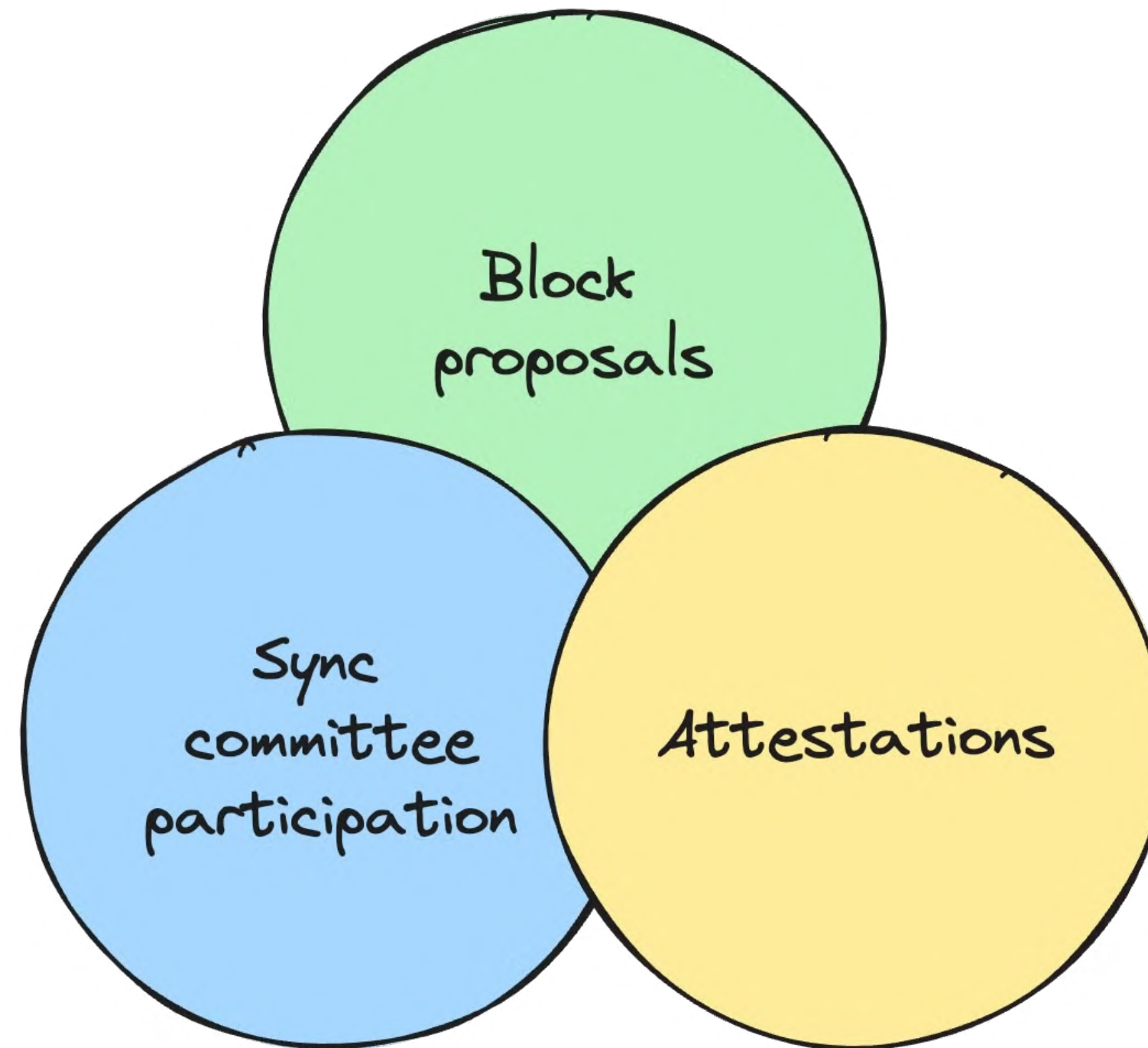
ETH validation issues

- Expensive

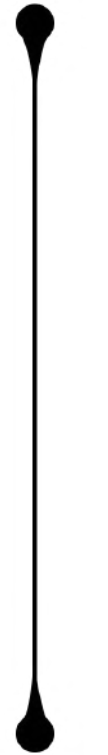
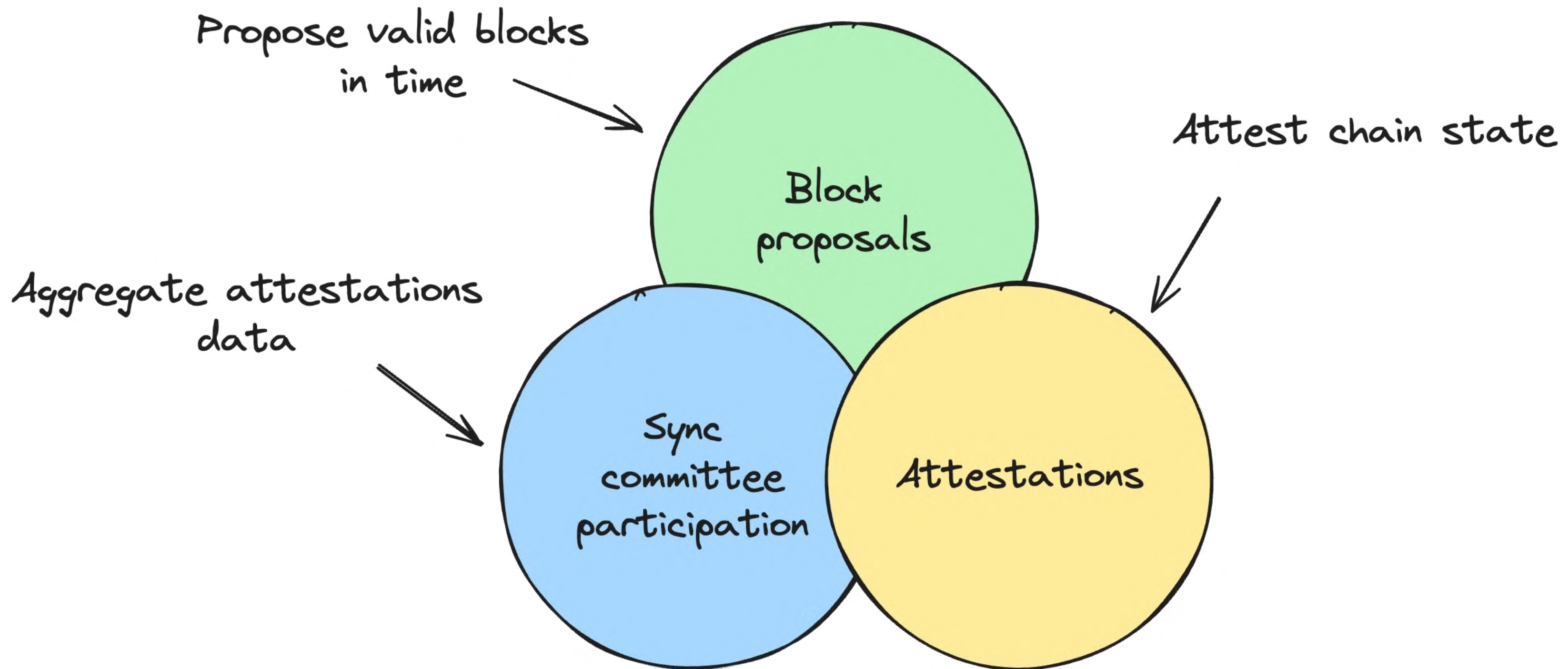


LIDO CSM

Validator's Duties



Validator's Duties

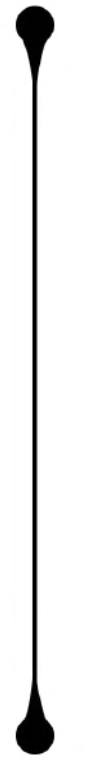
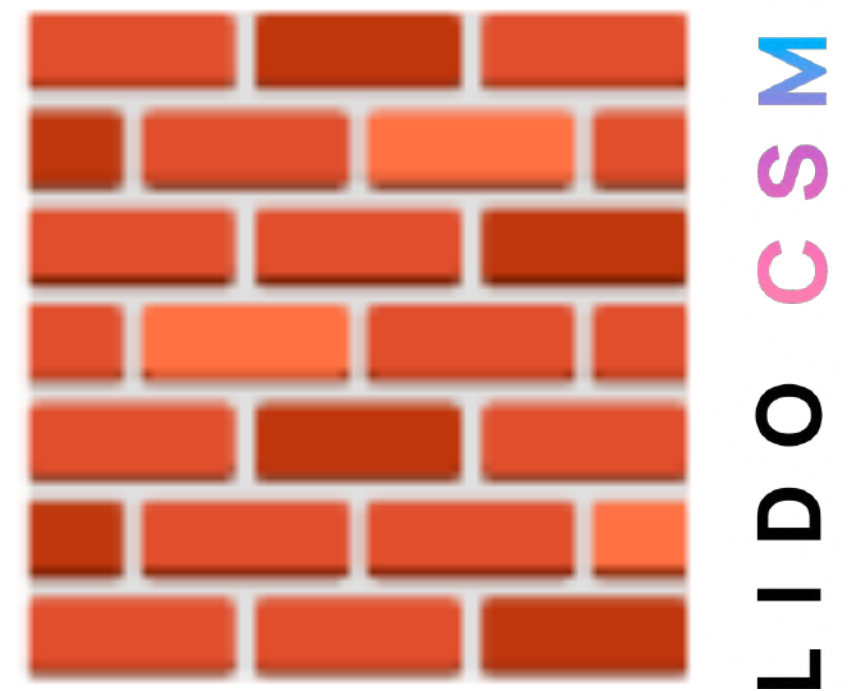


Block Proposals

Propose valid blocks

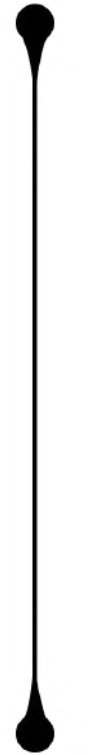
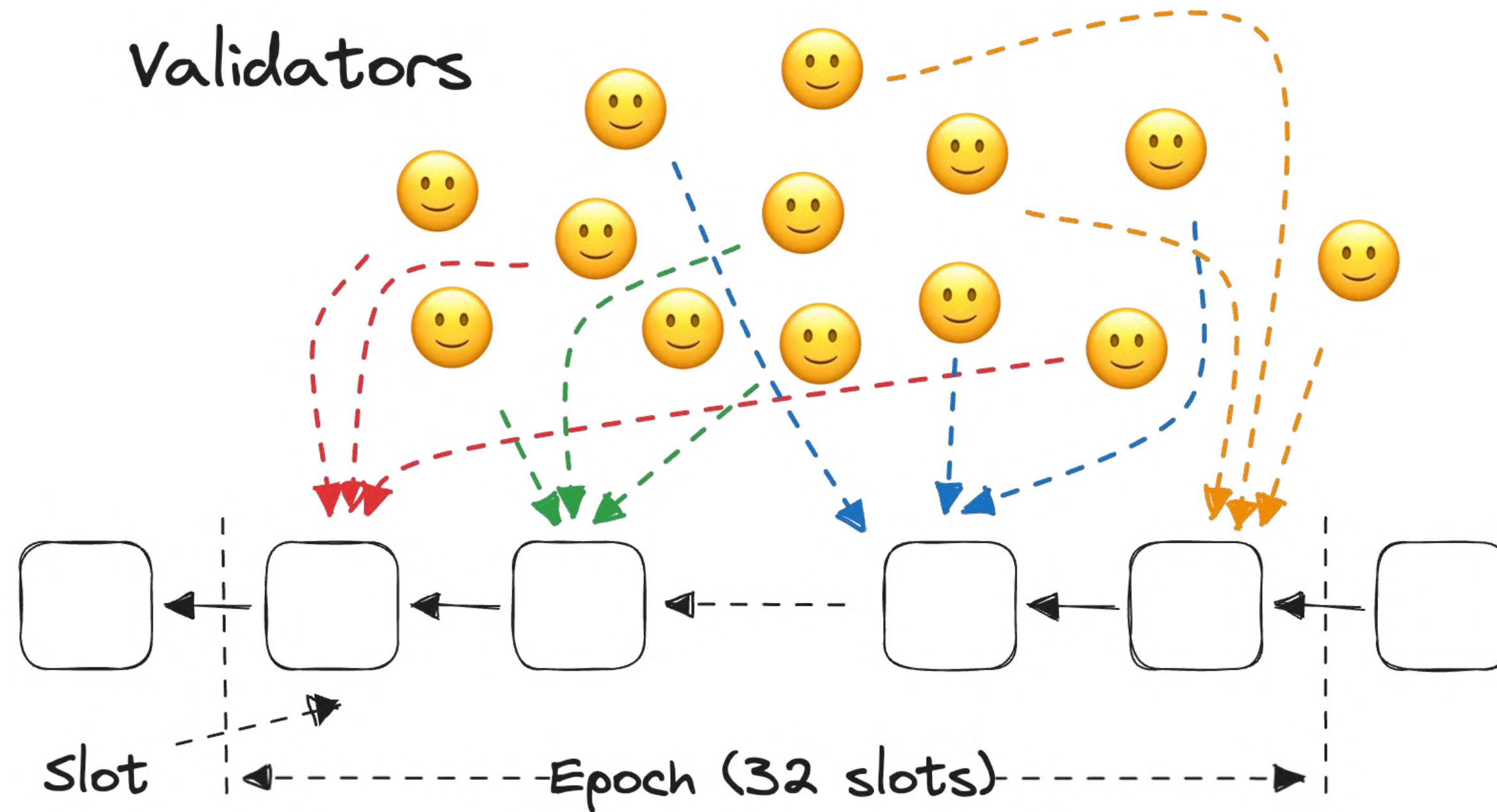
- Payload (Transactions)
- Attestations

Propose blocks in time



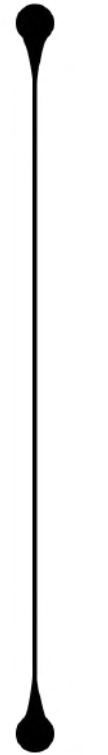
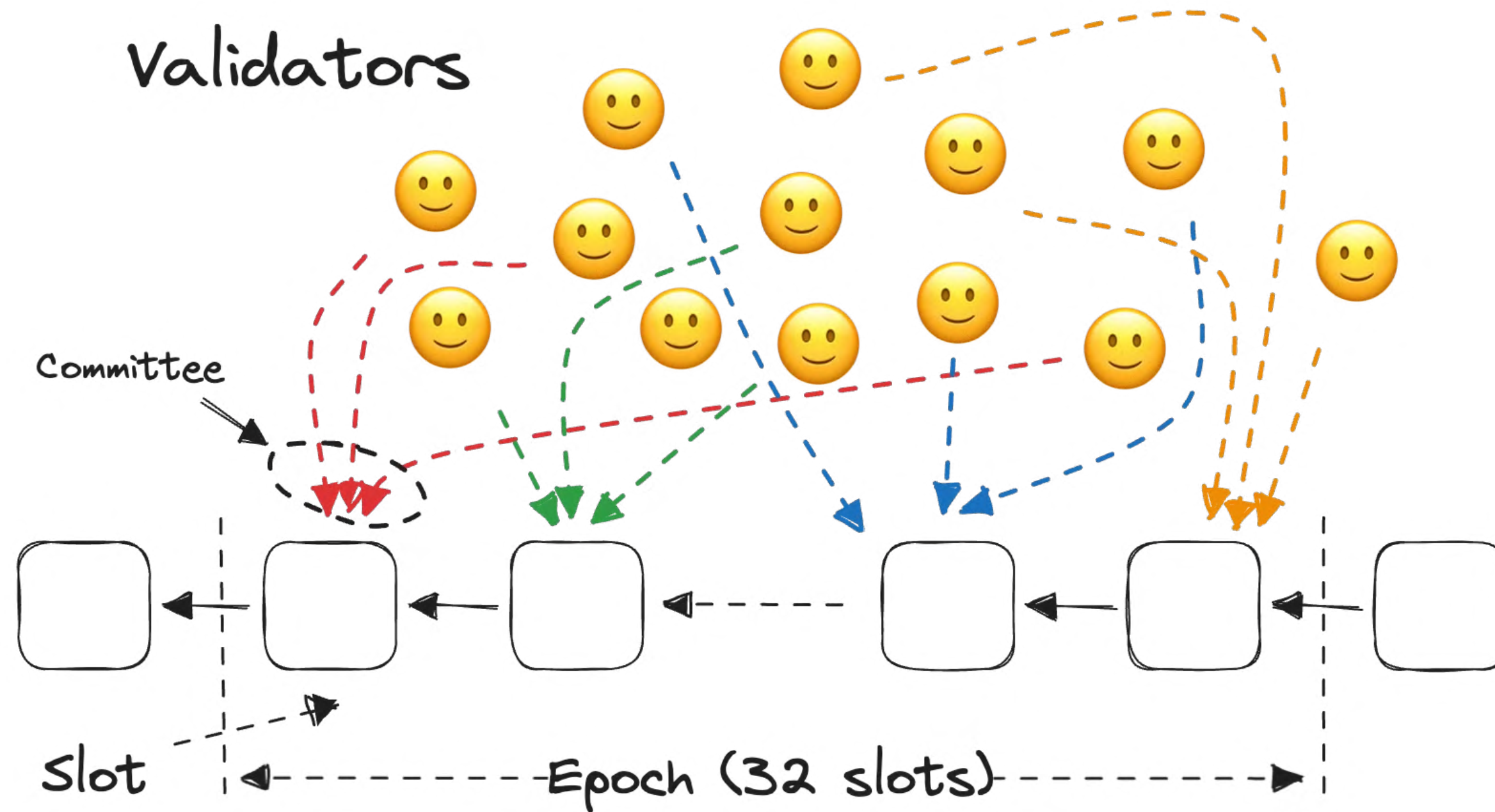
L I D O
C S M

Attestations



LIDO CSM

Attestations



LIDO CSM

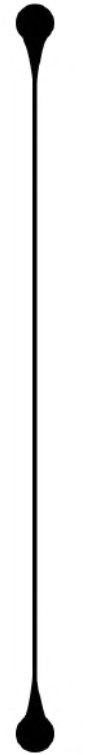
Attestations

Vote for the chain state

Head - fork choice

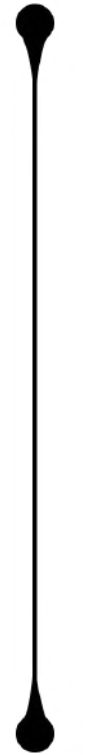
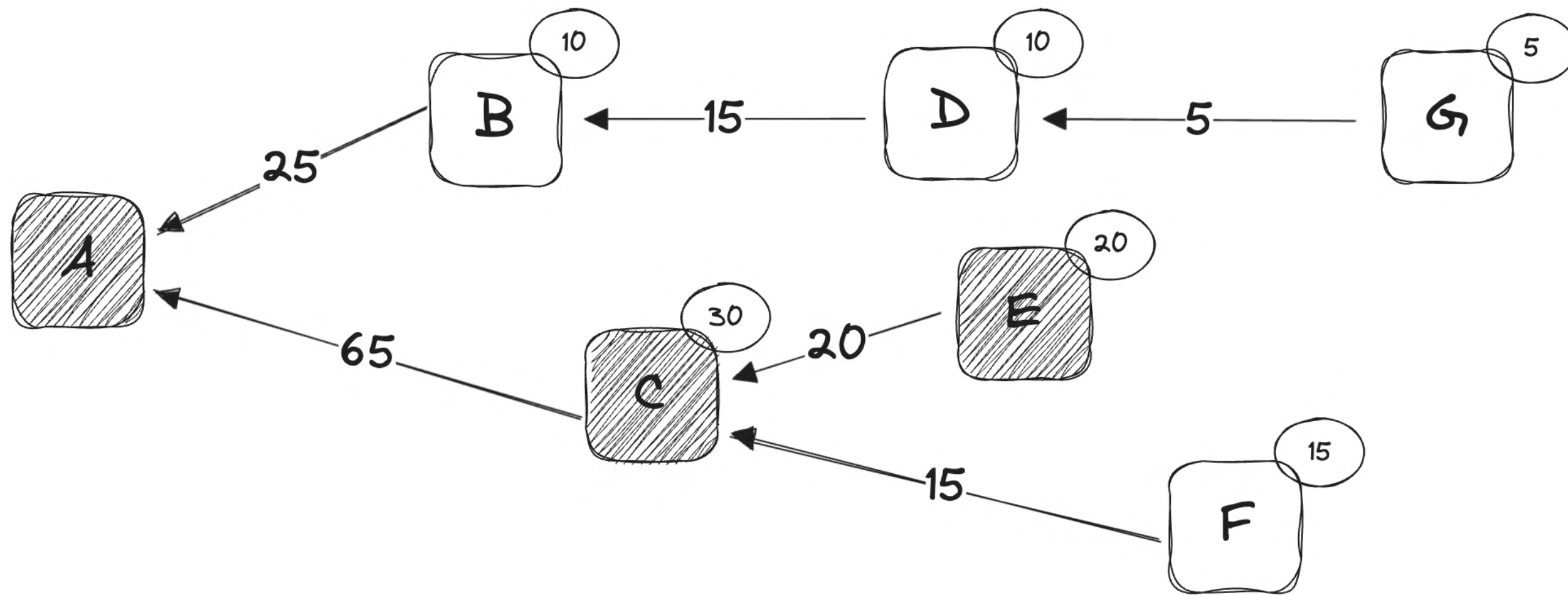
Source - finality

Target - finality



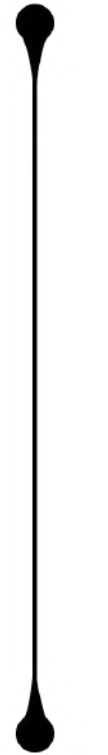
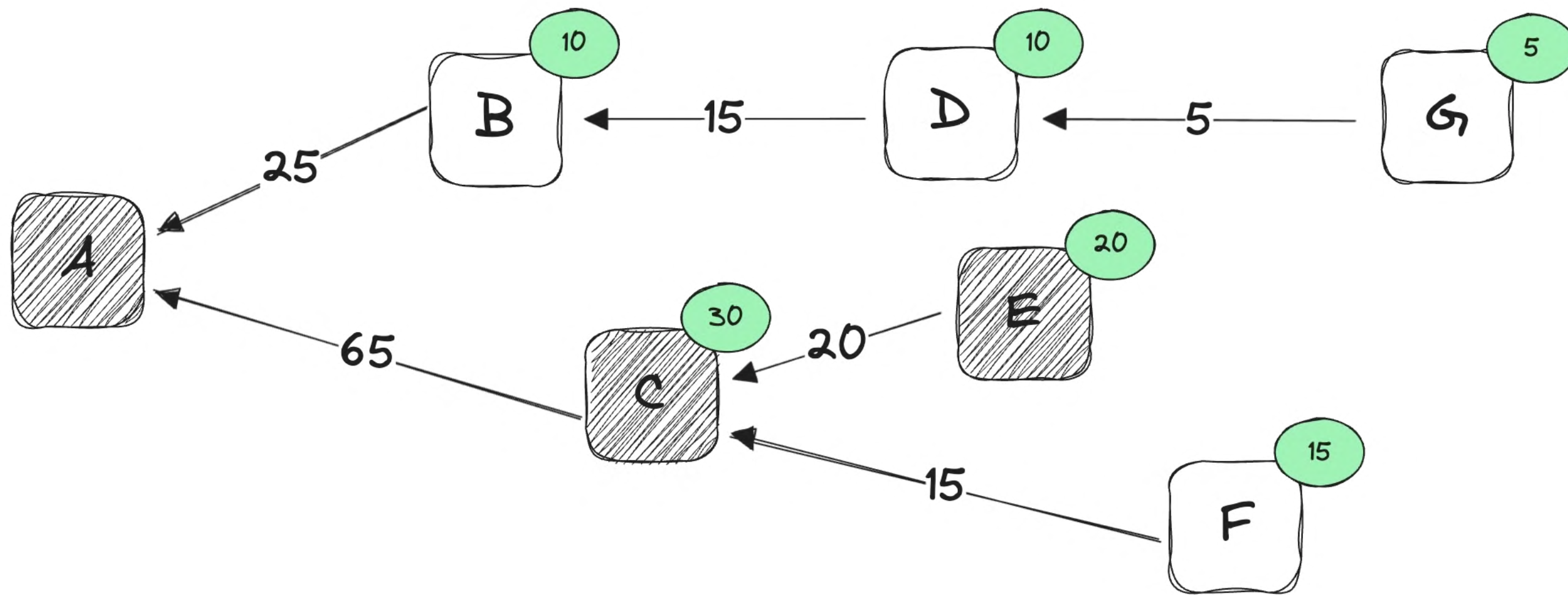
LIDO CSM

Head Vote



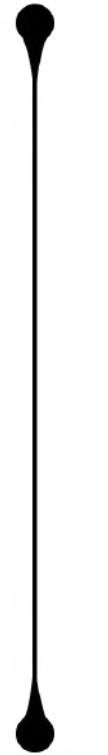
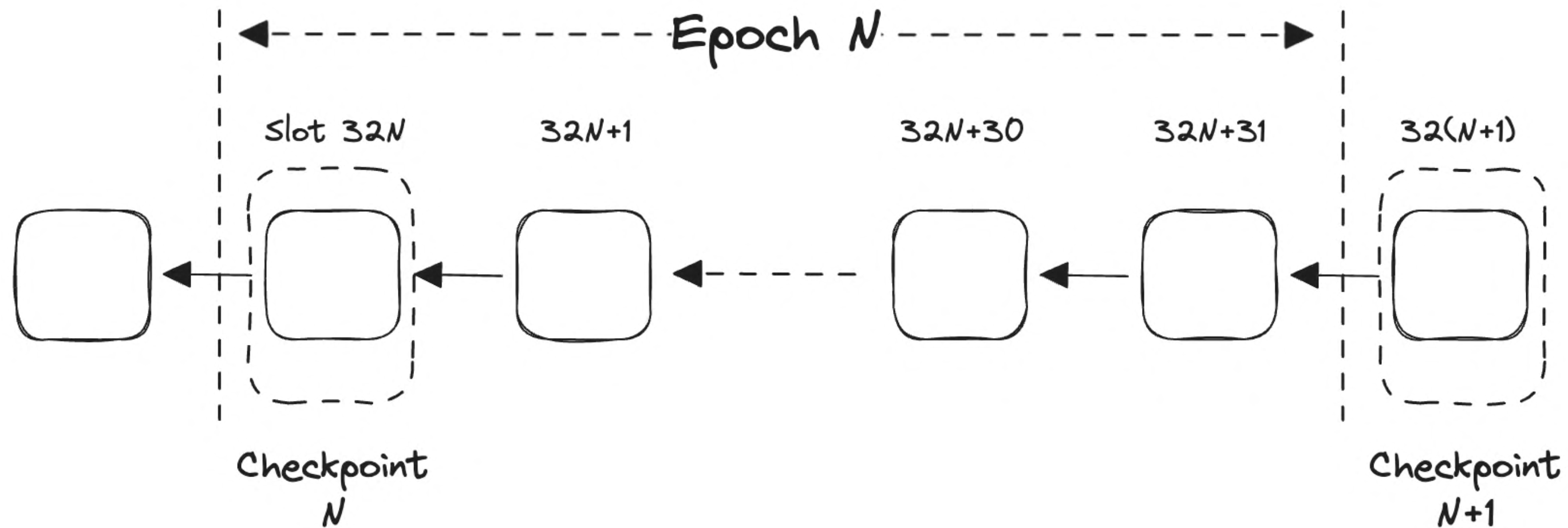
LIDO CSM

Head Vote

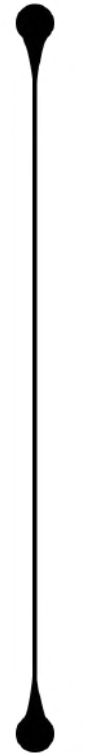
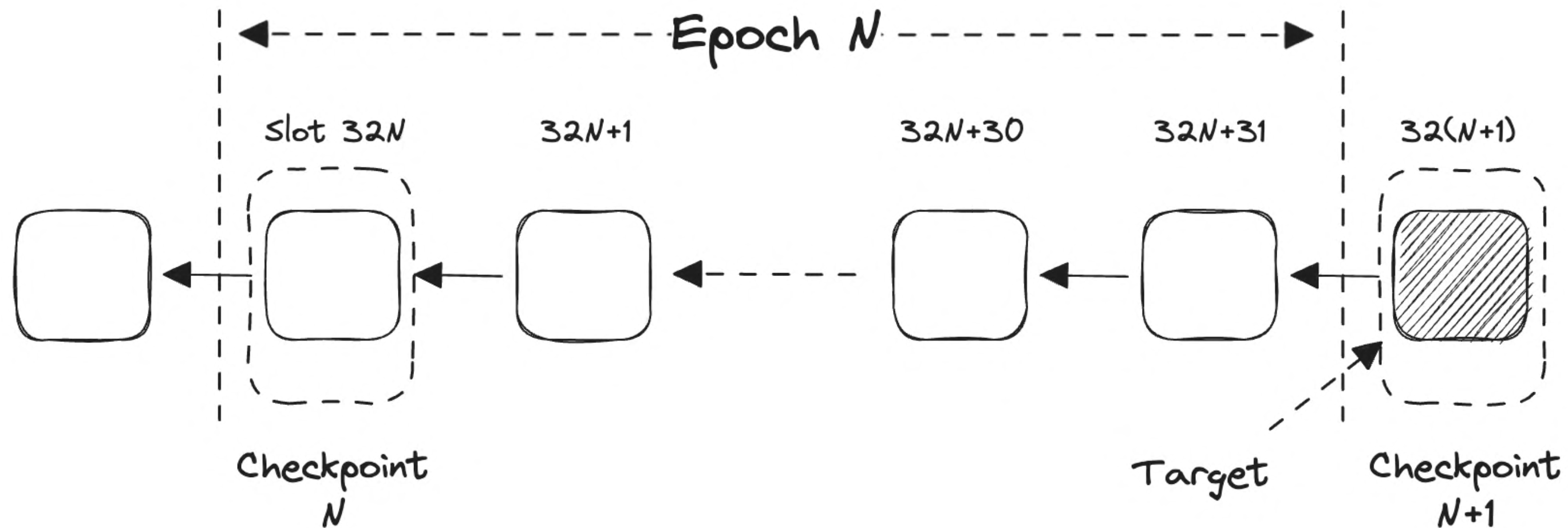


LIDO CSM

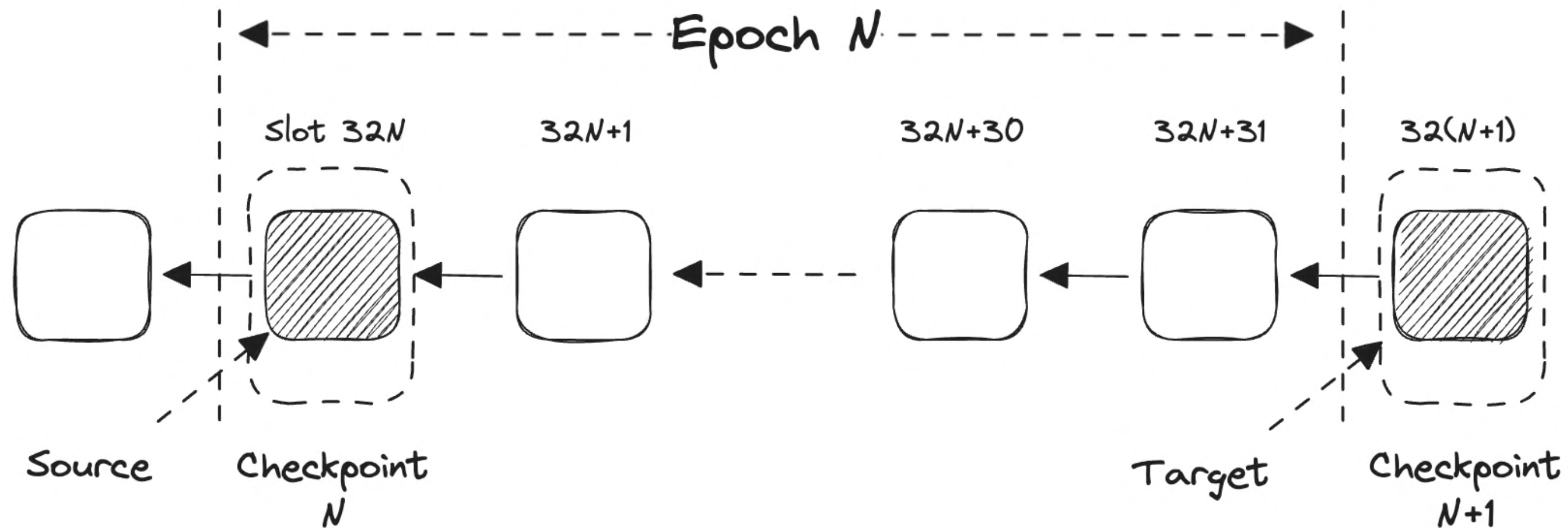
Source and Target votes



Source and Target votes



Source and Target votes



Sync Committee

The main goal of the sync committees is to
aggregate head votes
to allow light clients operation

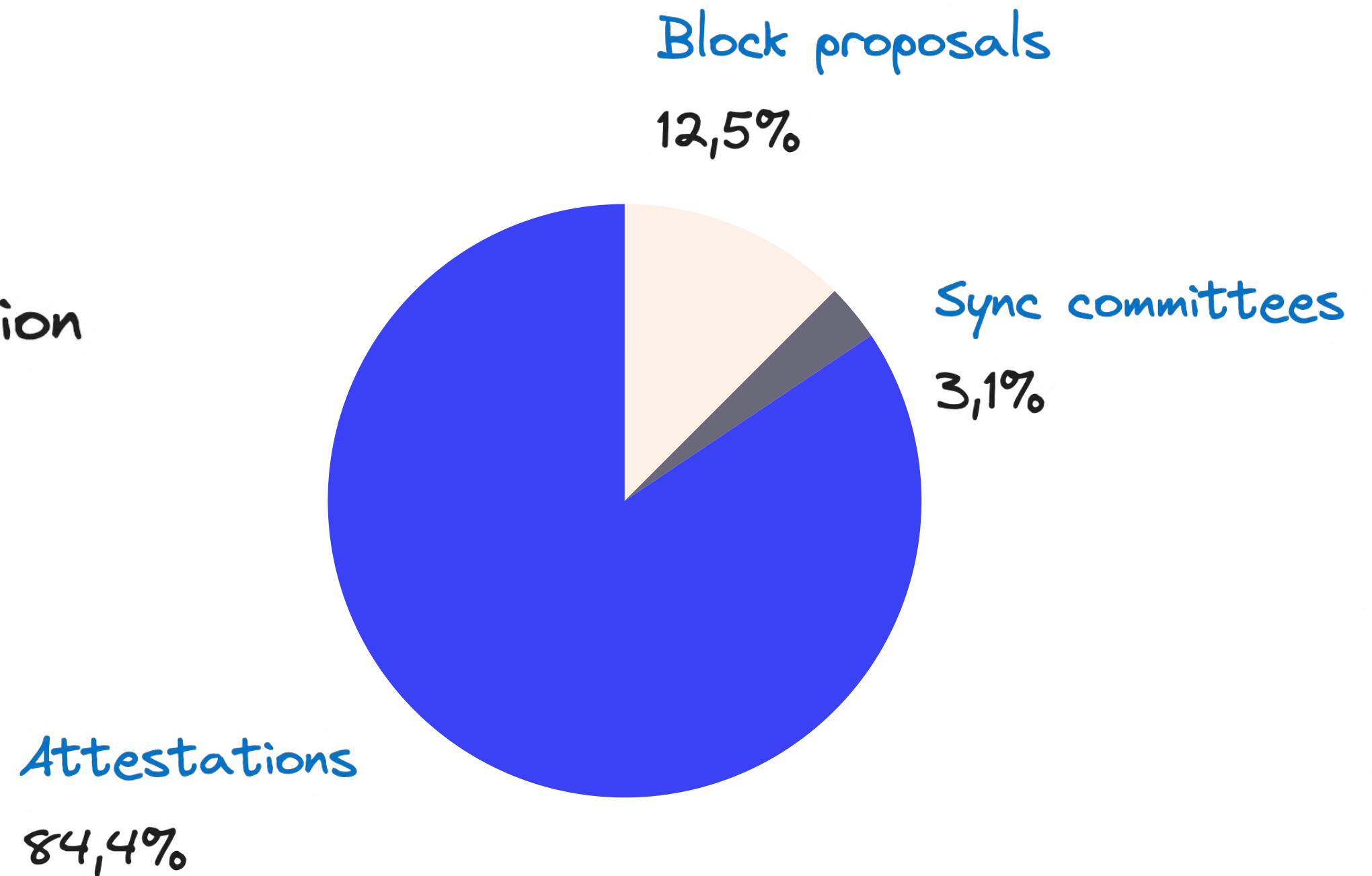


LIDO CSM

Validator's Rewards

Consensus layer

- Block proposals
- Attestations
- Sync committee participation
- Slashing reporting

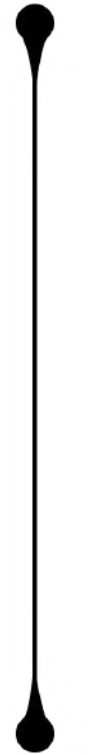
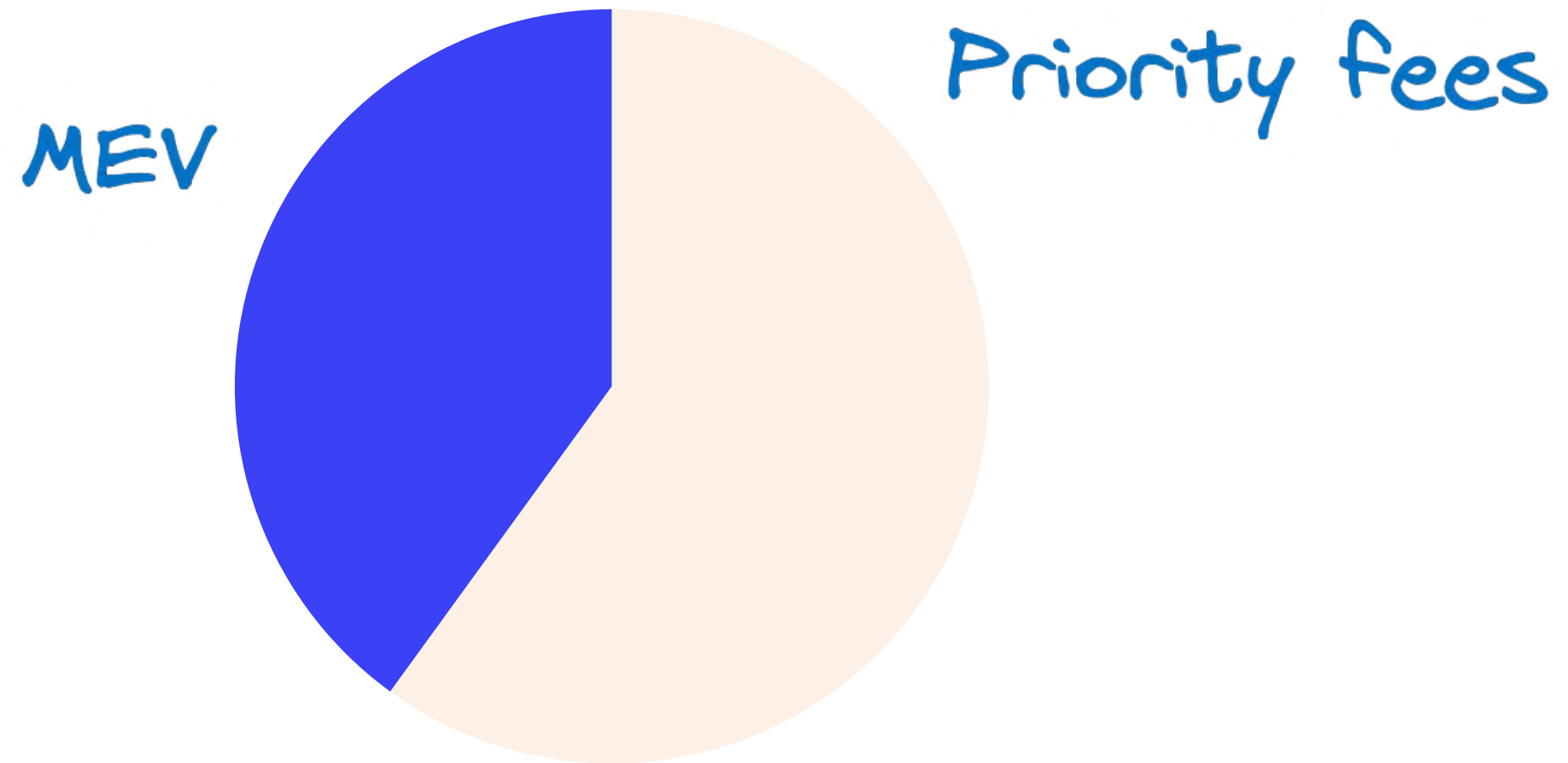


LIDO CSM

Validator's Rewards

Execution layer

- Priority fees
- MEV

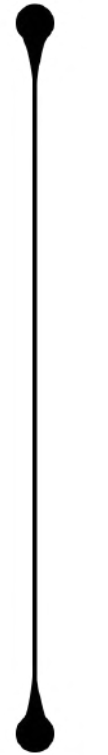
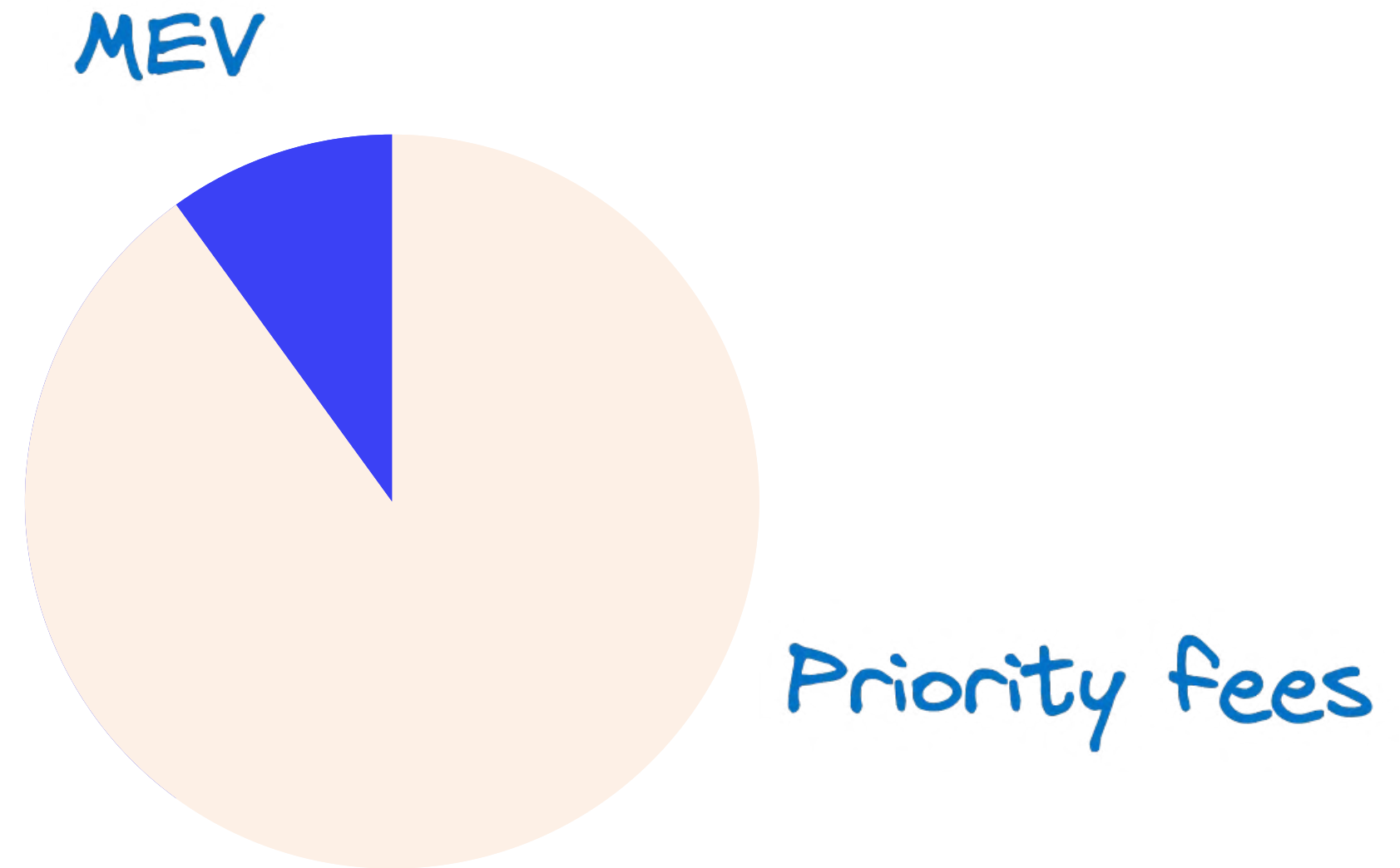


LIDO CSM

Validator's Rewards

Execution layer

- Priority fees
- MEV

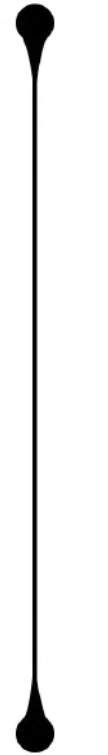
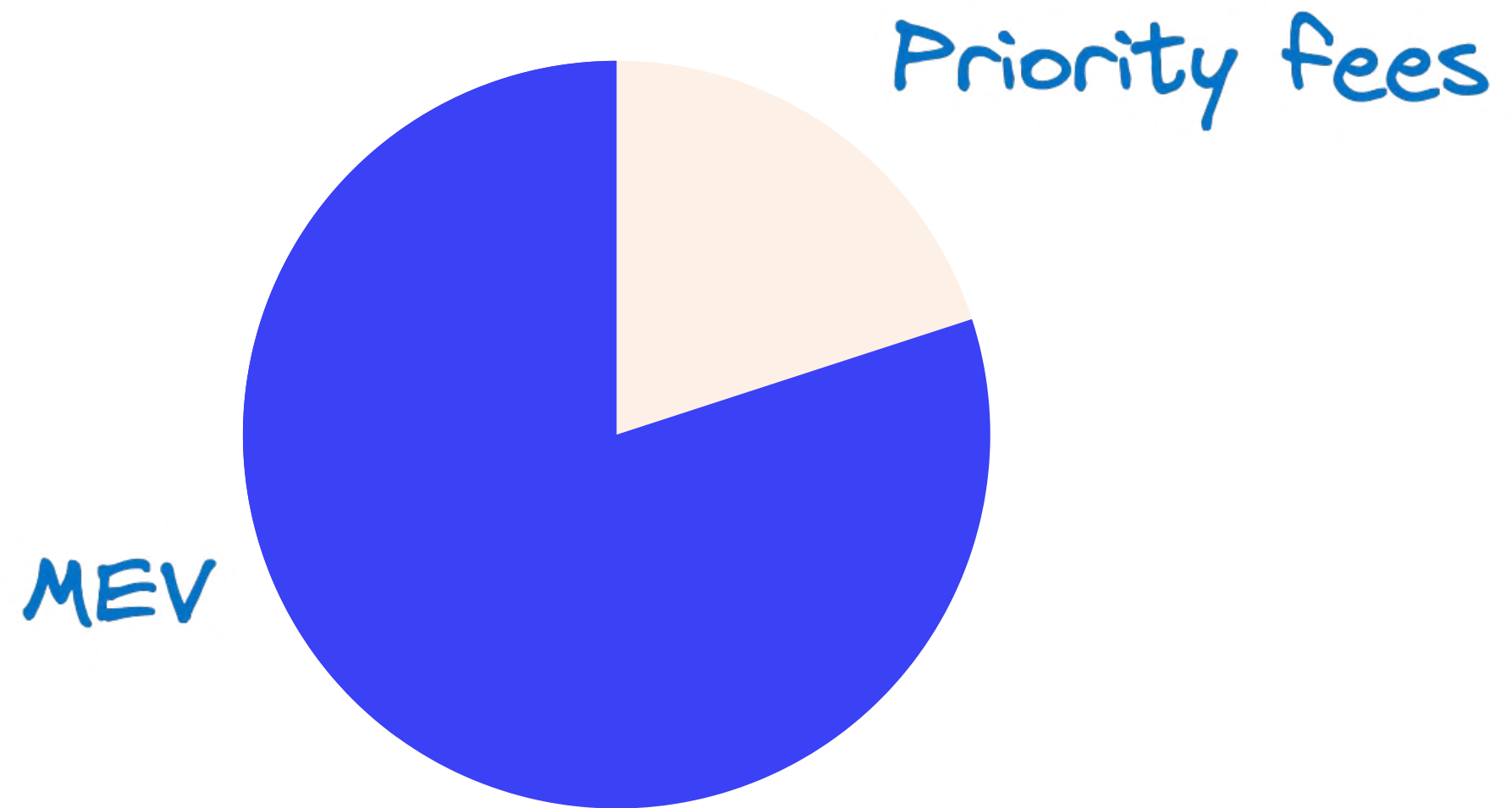


L I D O C S M

Validator's Rewards

Execution layer

- Priority fees
- MEV

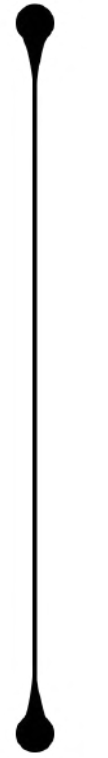


LIDO CSM

Validator's Rewards

Execution layer

MEV is a lottery!



LIDO CSM

Validator's Rewards

Mostly luck.
Highly volatile

Execution layer
rewards

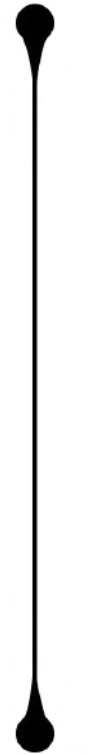
approx. 30%

+

Duties fulfilment.
Super stable

Consensus layer
rewards

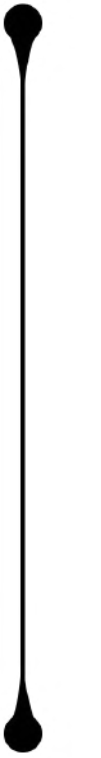
approx. 70%



LIDO CSM

ETH validation issues

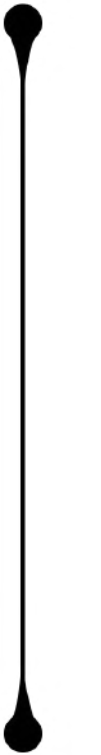
- Expensive
- Volatile rewards



LIDO CSM

Validator's Penalties

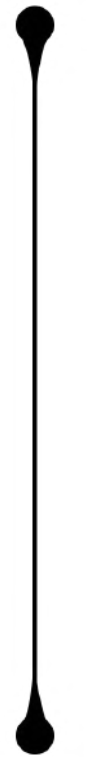
- Missed attestations
- Missed sync committee participation
- Slashing



L I D O C S M

ETH validation issues

- Expensive
- Volatile rewards
- Penalties for a small outages

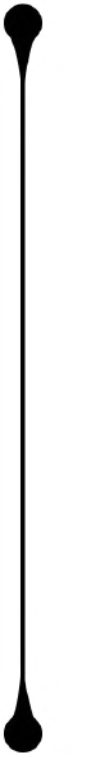


LIDO CSM

Slashing

The validator is slashed in case of consensus rule violations

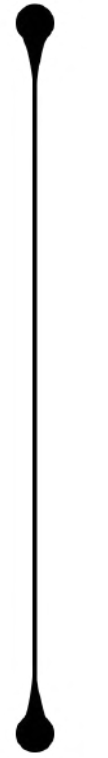
The most common slashing case is the "double signature" of a block proposal or attestation



LIDO CSM

Slashing

Slashed validators are ejected from the validator set after the slashing period (usually 36 days) and are subject to slashing penalties



LIDO CSM

Slashing Penalties

- Initial (minimal) slashing penalty

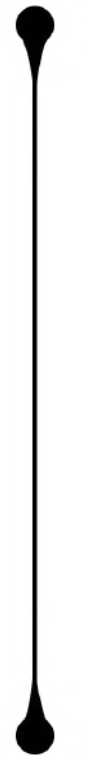
1/32 of the validator's effective balance (1 ETH)

- Correlation (midterm) penalty

from 0 ETH to `MAX_EFFECTIVE_BALANCE`

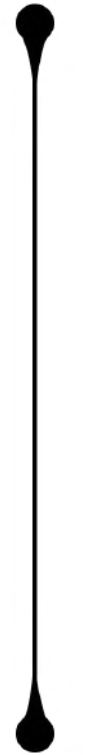
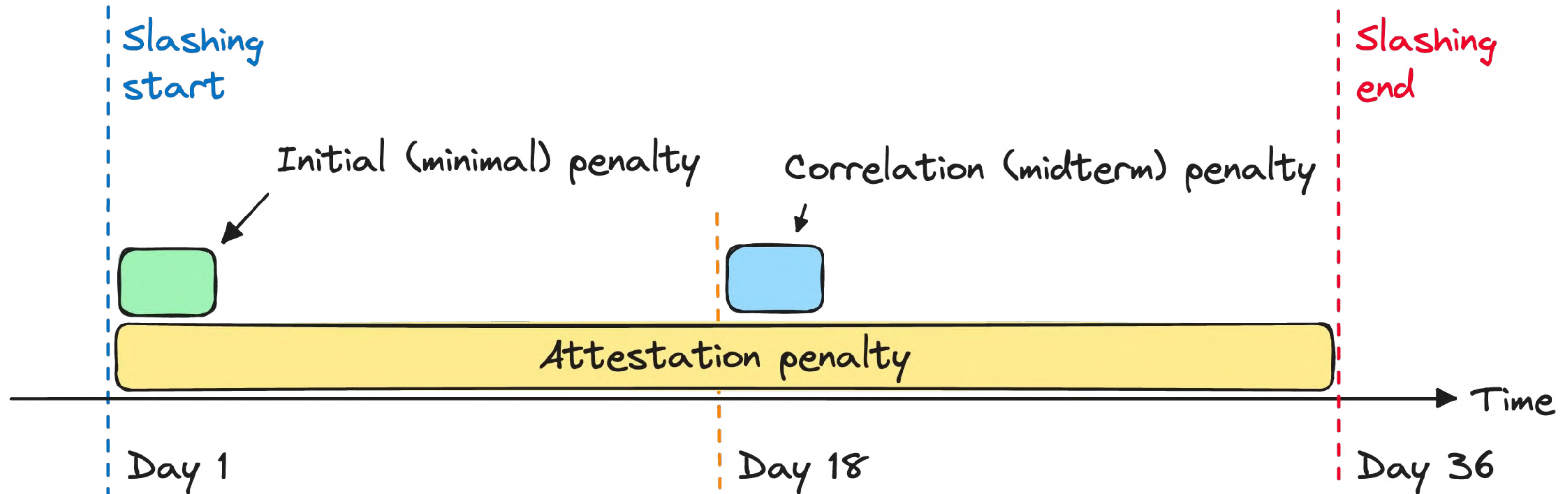
- Missed attestations penalty

during all slashing period



LIDO CSM

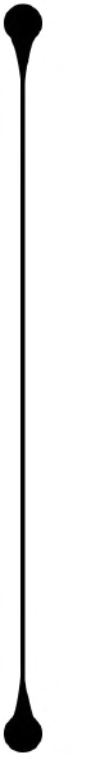
Slashing Penalties



LIDO
CSM

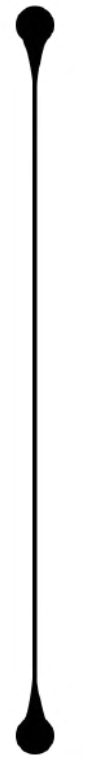
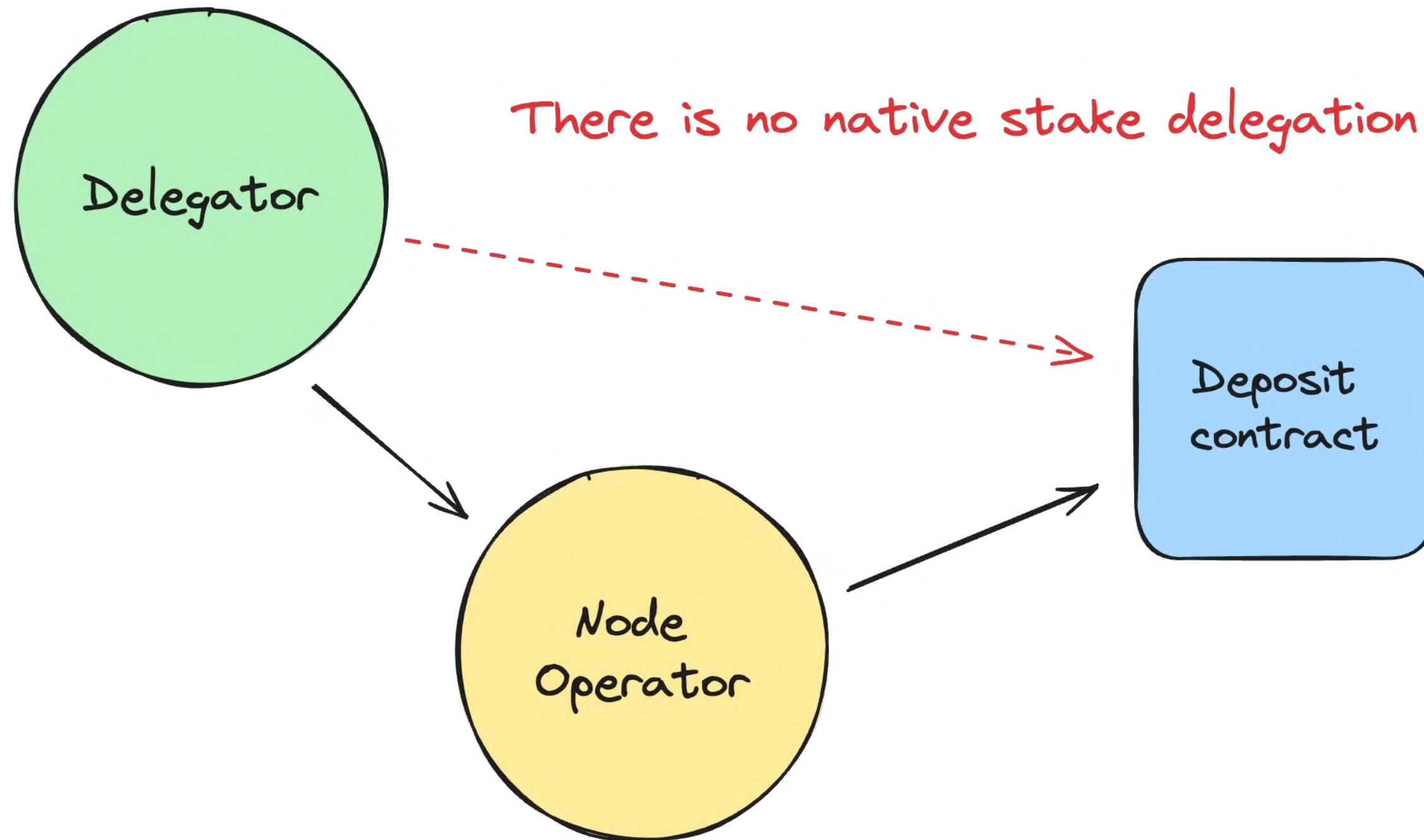
Slashing Penalties

The total penalties are approx. 1.x ETH
for the common slashing case

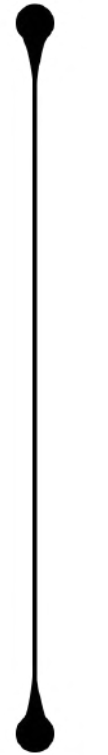
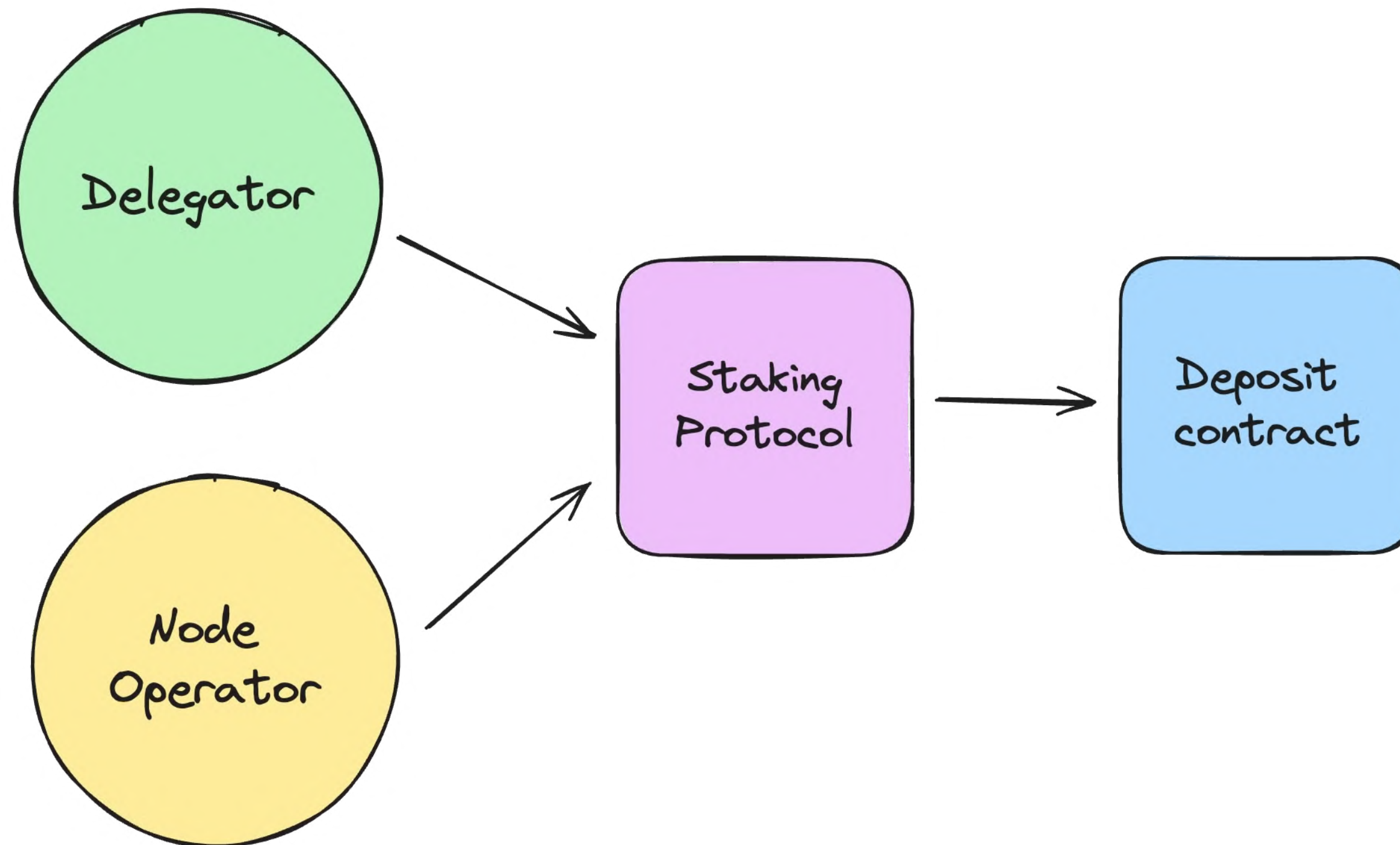


LIDO CSM

Delegated Staking



Delegated Staking



LIDO CSM

source: <https://lido.fi/>

ETH validation issues

- Expensive
- Volatile rewards
- Penalties for a small outages
- No native delegation



Node Operator UX

- 1 Proof of stake
- 2 Deposit
- 3 The terminal
- 4 Uptime
- 5 Bad behavior
- 6 Key management
- 7 Early adoption risks
- 8 Checklist
- 9 Confirmation

Proof of stake

Ethereum uses proof-of-stake to reach consensus.

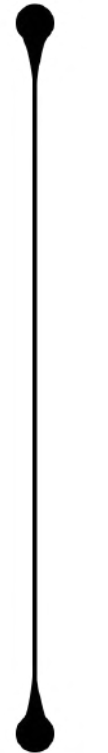
For this, we need active participants—known as validators—to propose, verify, and vouch for the validity of blocks. In exchange, honest validators receive financial rewards.

Importantly, as a validator you'll need to post ETH as collateral—in other words, have some funds at stake. The only way to become a validator is to make a one-way ETH transaction to the deposit contract on the Mainnet execution layer. The Beacon Chain (consensus layer) is used in parallel to keep track of all validator activity.

[More on the Beacon Chain ↗](#)

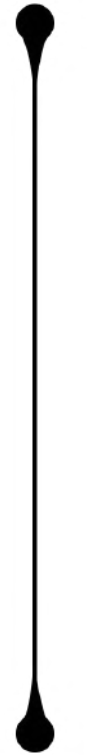
[More on proof of stake ↗](#)

CONTINUE



LIDO CSM

Node Operator UX



LIDO
CSM

1 Proof of stake

2 Deposit

3 The terminal

4 Uptime

5 Bad behavior

6 Key management

7 Early adoption risks

8 Checklist

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Proof of stake

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[More on the Beacon Chain ↗](#)

[More on proof of stake ↗](#)

Native UX is a bit challenging

CONTINUE

ETH validation issues

- Expensive
- Volatile rewards
- Penalties for a small outages
- No native delegation
- Challenging UX



ETH validation issues

- Expensive
- Volatile rewards
- Penalties for a small outages
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Looks like
a lot of issues...



LIDO CSM

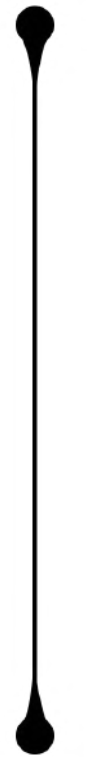
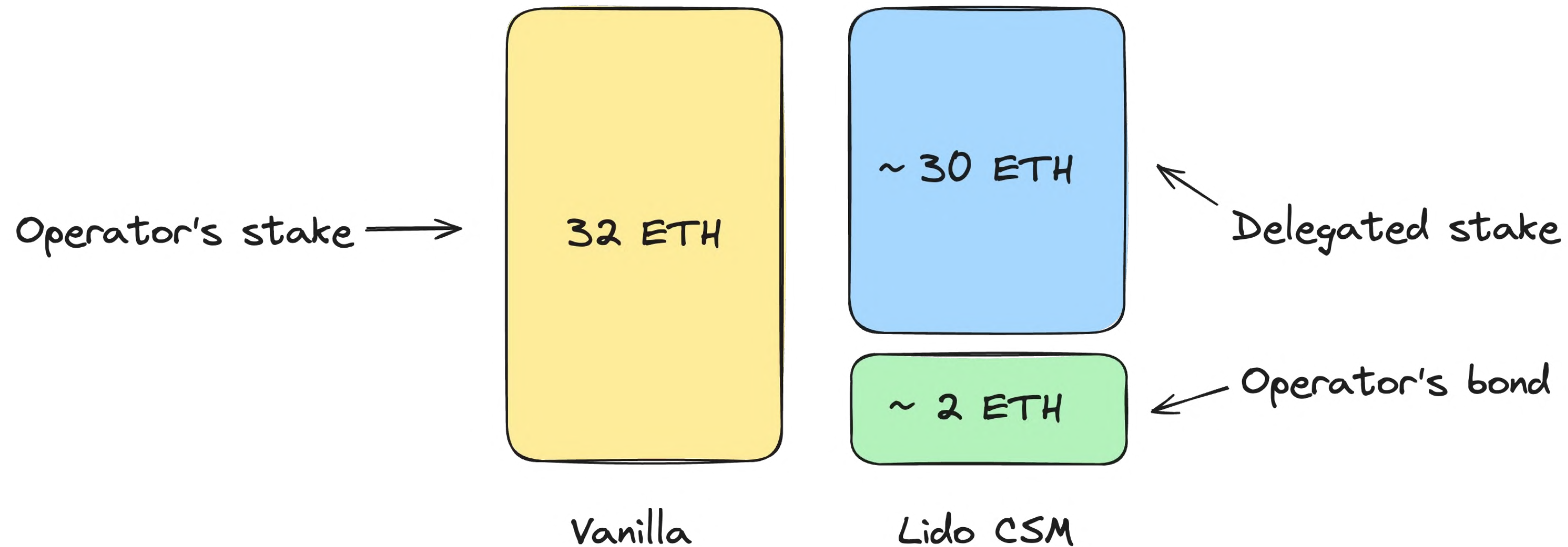
Making ETH validation simpler

with Lido CSM



LIDO CSM

Adding Delegation



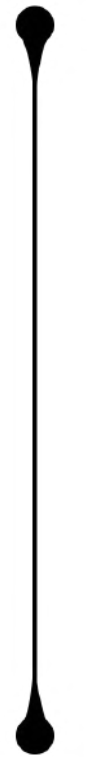
LIDO CSM

ETH validation issues

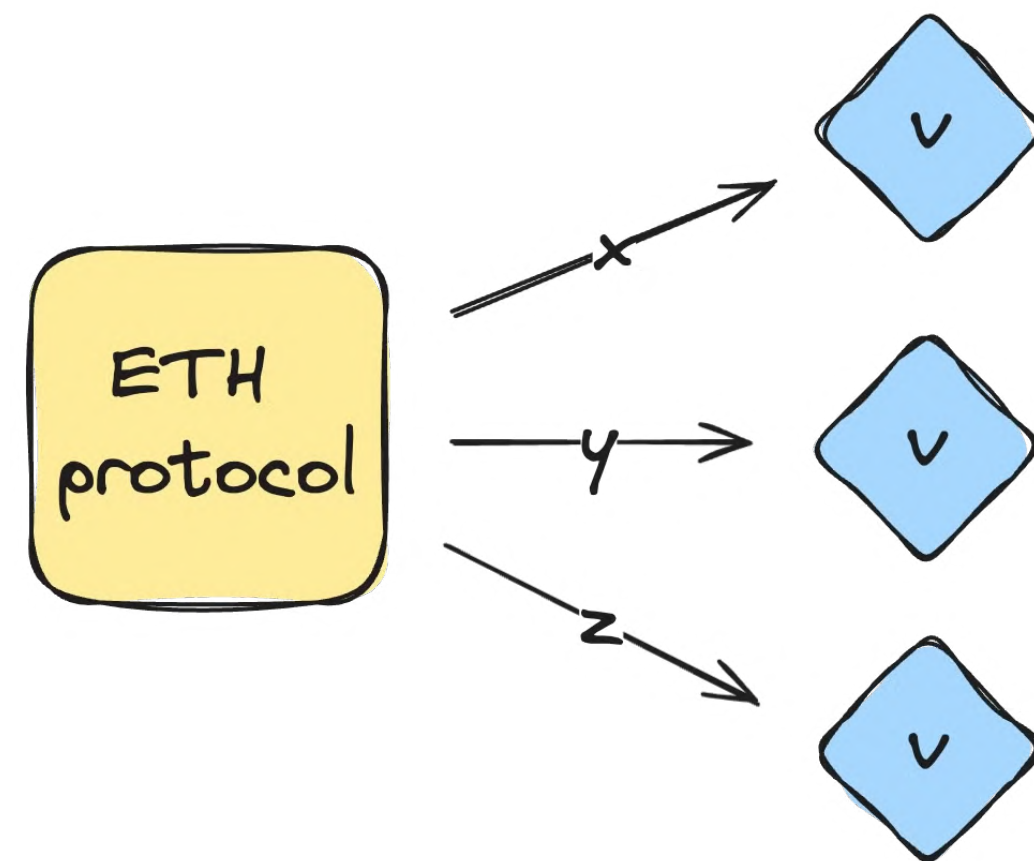
- ~~Expensive~~
- Volatile rewards
- Penalties for a small outages
- ~~No native delegation~~
- Challenging UX

Resolved with CSM

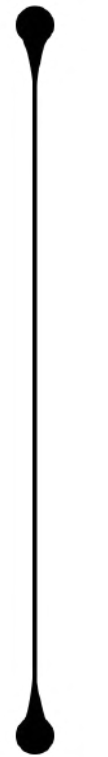
- ✓ ~ 2 ETH to start
- ✓ Delegation



Smoothing Rewards

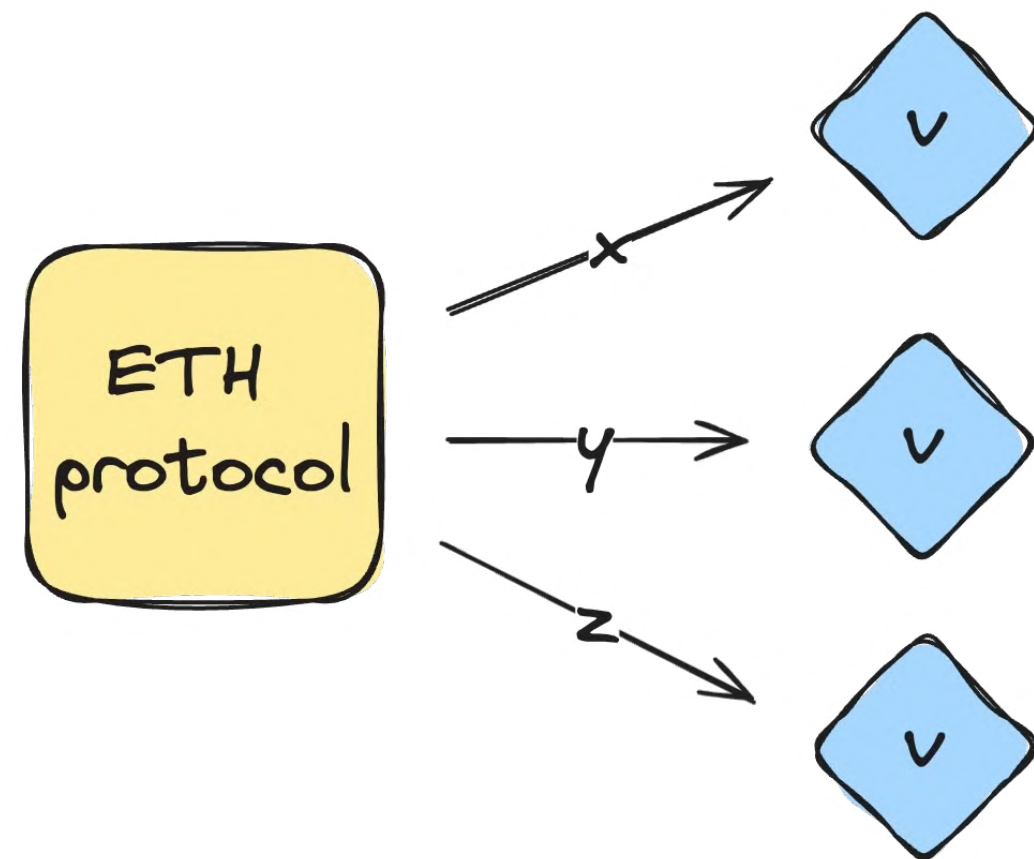


Vanilla

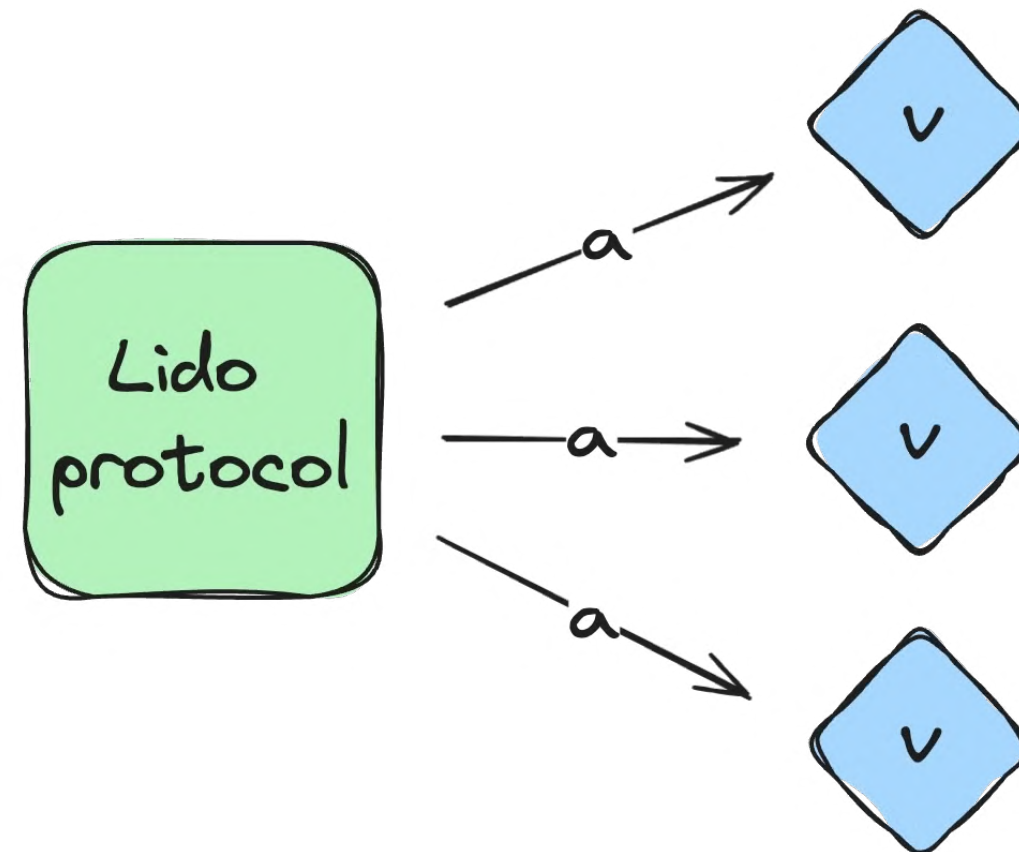


LIDO CSM

Smoothing Rewards



Vanilla



Lido CSM



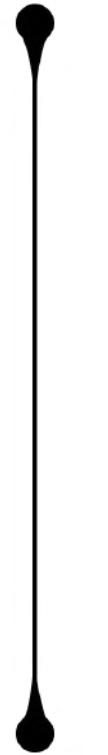
LIDO CSM

ETH validation issues

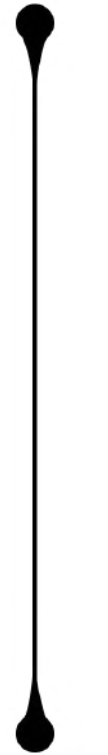
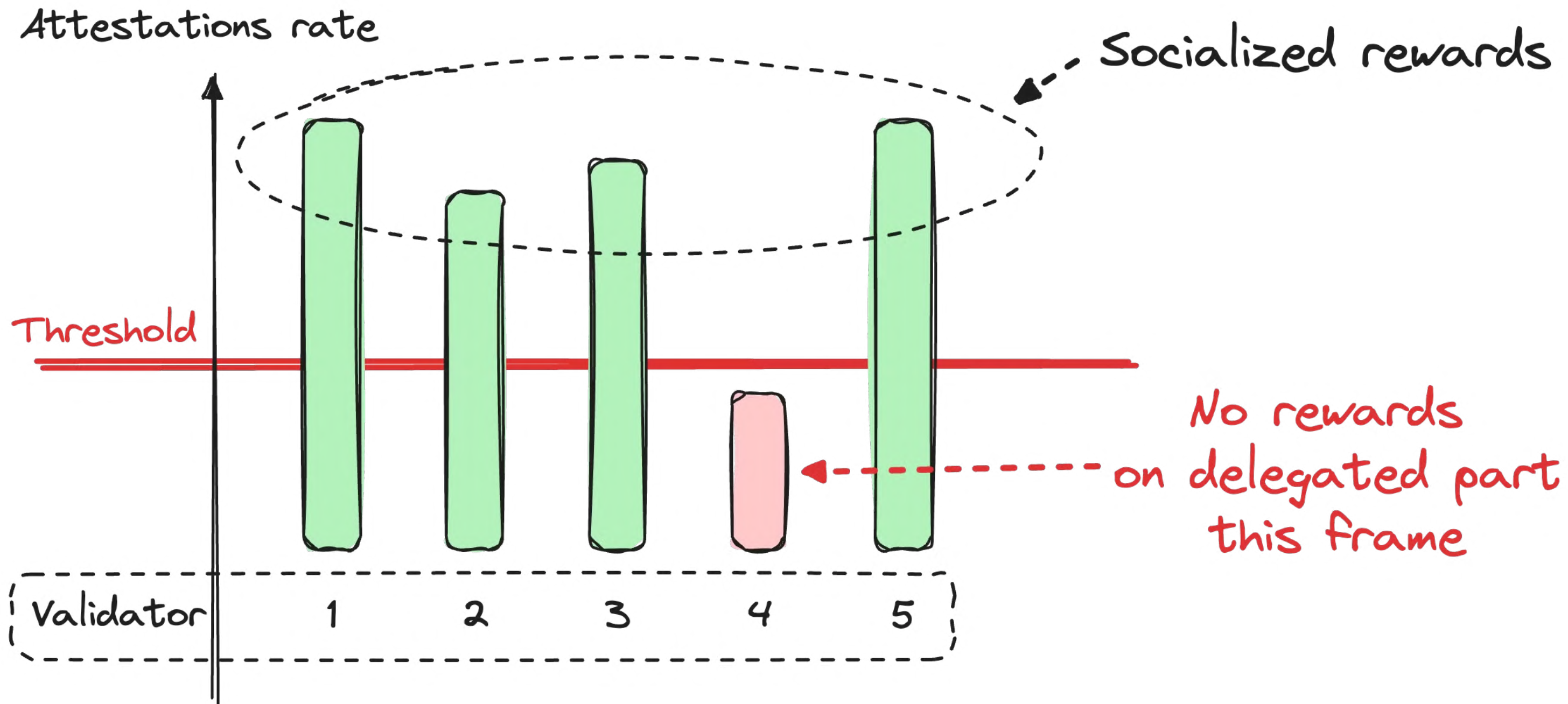
- ~~Expensive~~
- ~~Volatile rewards~~
- Penalties for a small outages
- ~~No native delegation~~
- Challenging UX

Resolved with CSM

- ✓ ~ 2 ETH to start
- ✓ Delegation
- ✓ Smooth rewards



Adding Performance threshold



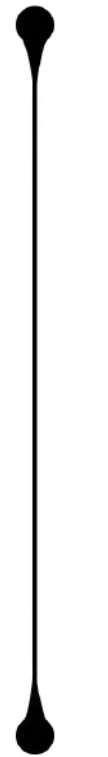
LIDO CSM

ETH validation issues

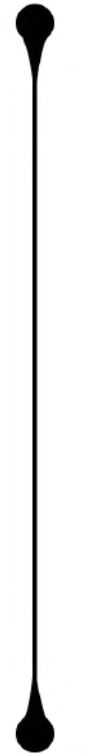
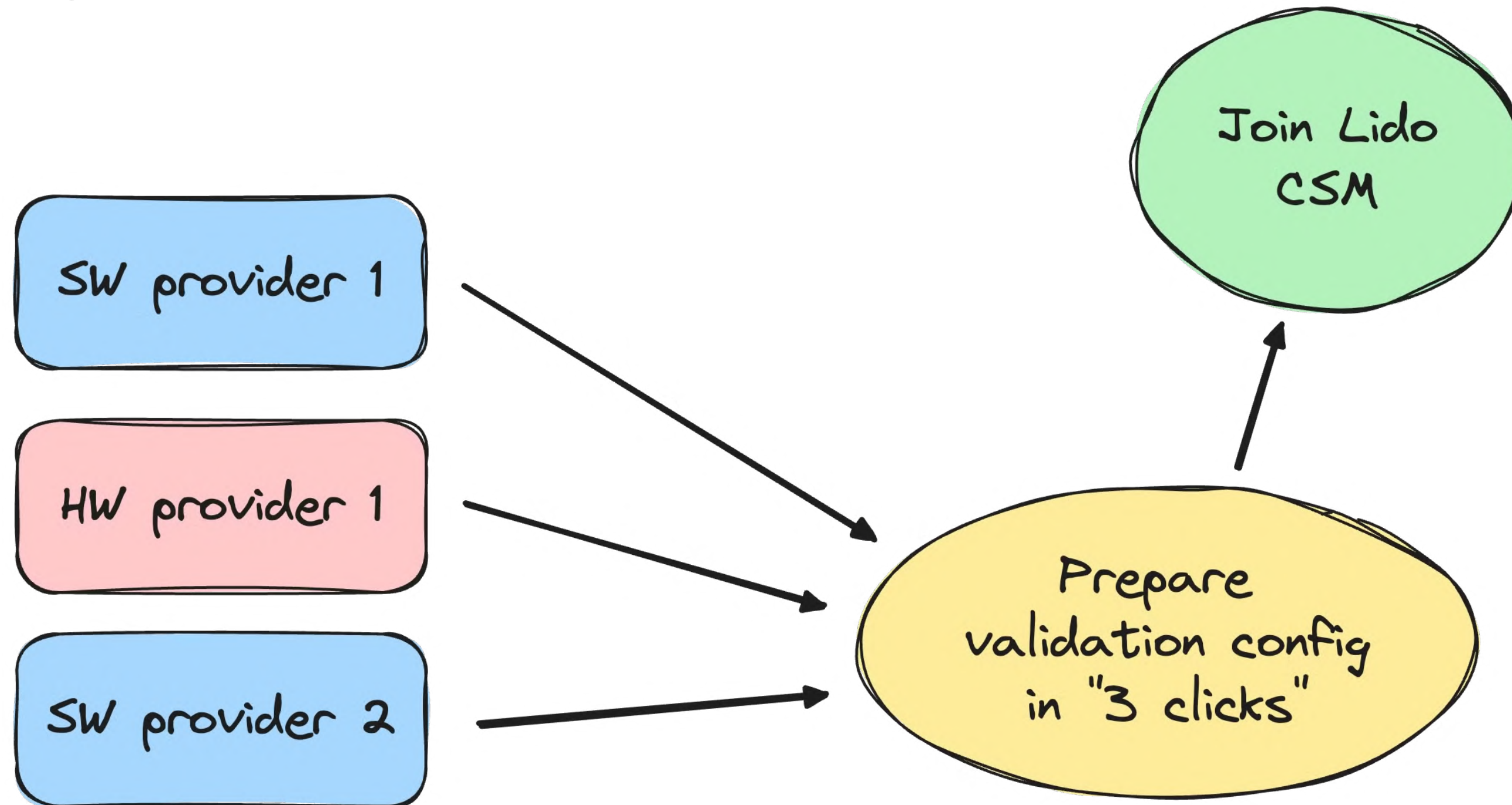
- ~~Expensive~~
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Resolved with CSM

- ✓ ~ 2 ETH to start
- ✓ Delegation
- ✓ Smooth rewards
- ✓ Leeway for a small outages

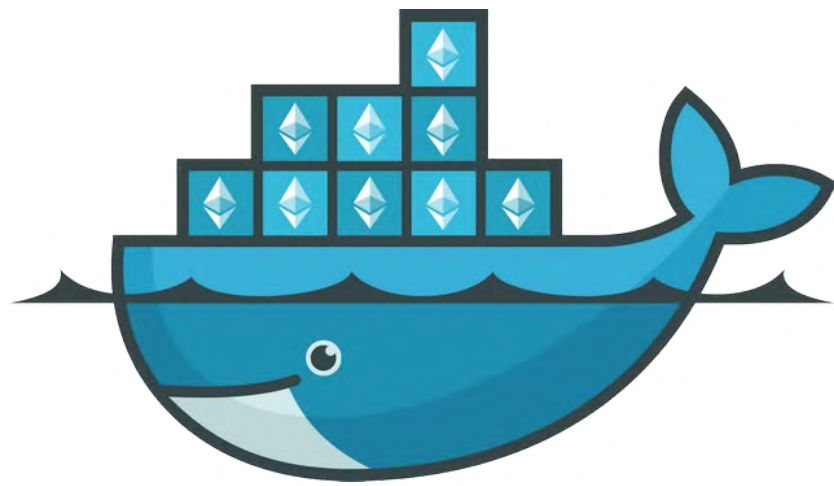


Integrations



LIDO CSM

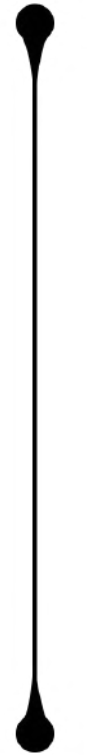
Integrations



dappnode



NETHERMIND



LIDO CSM

ETH validation issues

- ~~- Expensive~~
- ~~- Volatile rewards~~
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- ~~- No native delegation~~
- ~~- Challenging UX~~

Resolved with CSM

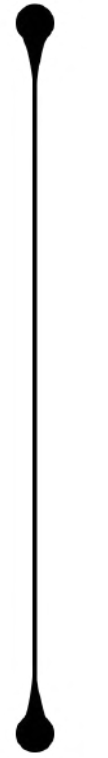
- ✓ ~ 2 ETH to start
- ✓ Delegation
- ✓ Smooth rewards
- ✓ Leeway for a small outages
- ✓ Best UX in crypto



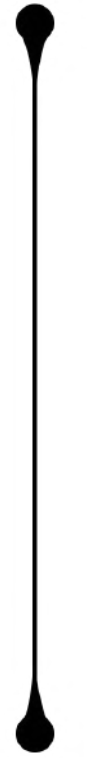
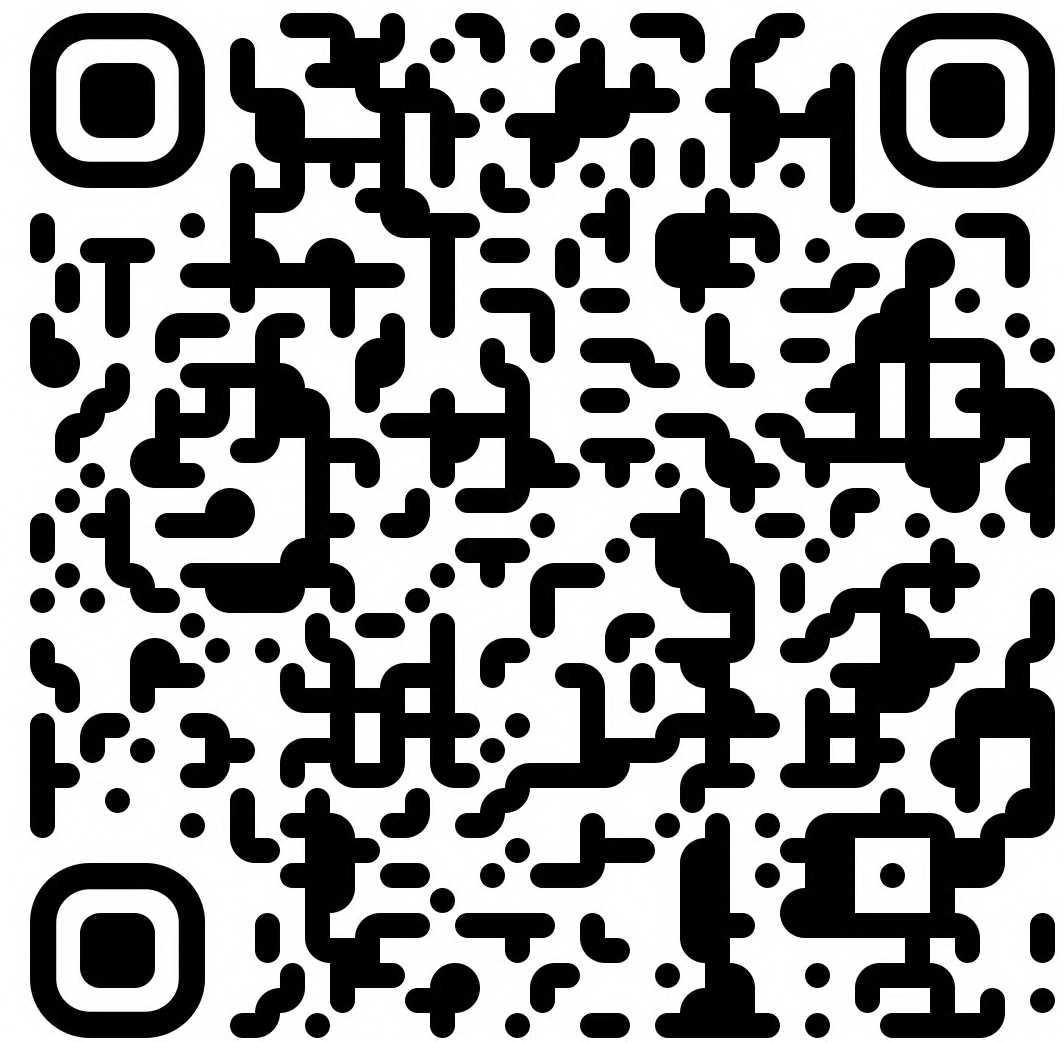
Resolved with CSM

- ✓ ~ 2 ETH to start
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Lido CSM
is your best friend
in ETH validation!

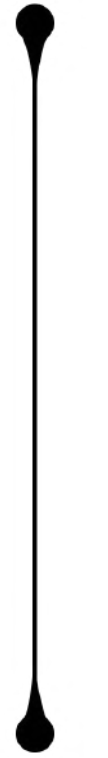
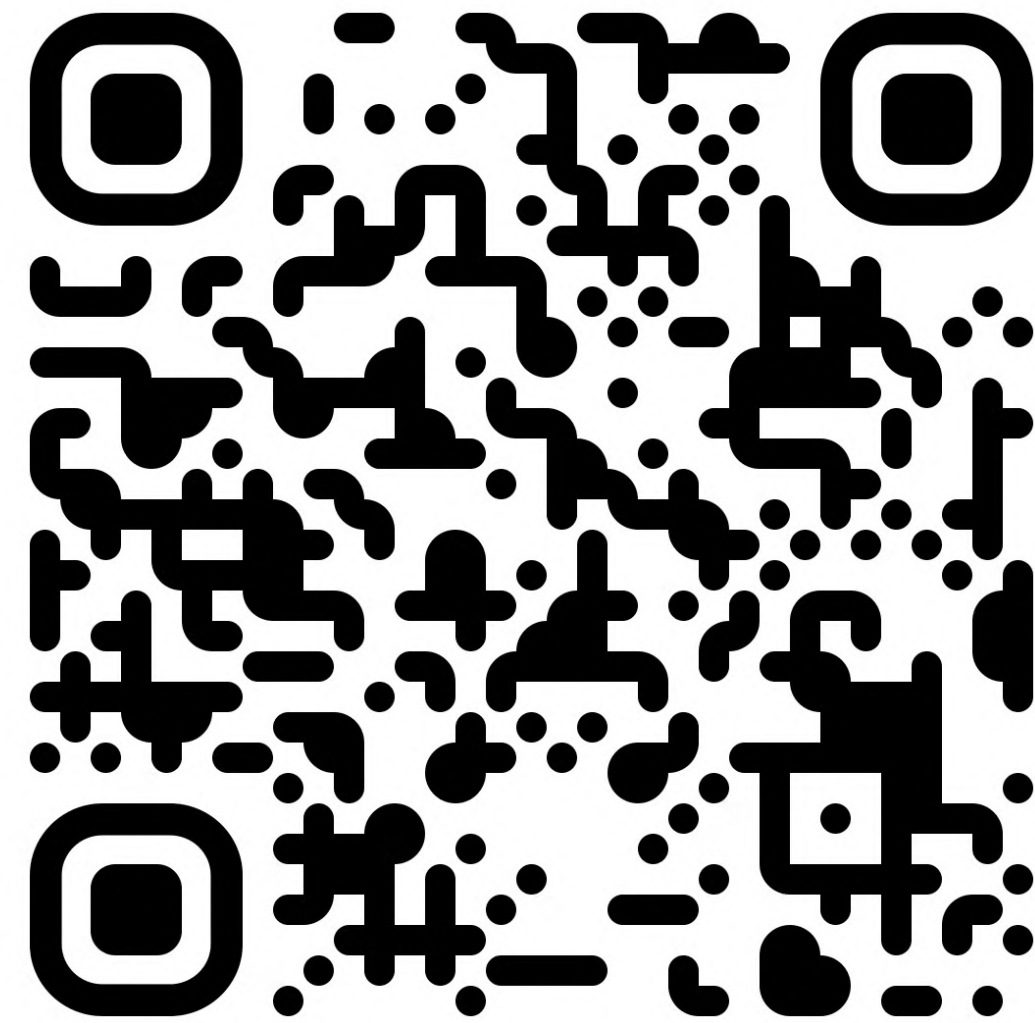


Learn more about CSM



LIDO CSM

Get your Early Adoption ticket



LIDO CSM



LIDO CSM

In **ETH** we trust!

