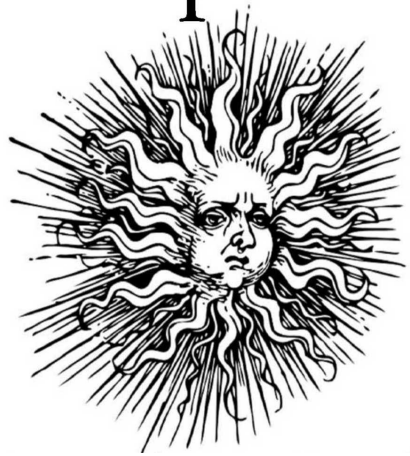
Increase the MAX_EFFECTIVE_BALANCE; EIP-7251

A Modest Proposal



mike neuder – ethereum foundation
ethstaker, staking gathering – devconnect
november 13, 2023

Outline

- Problem
  - What is `MAX_EFFECTIVE_BALANCE`?
  - What is the partial withdrawals sweep?
  - What happens as a result?

Outline

- Problem
  - What is `MAX_EFFECTIVE_BALANCE`?
  - What is the partial withdrawals sweep?
  - What happens as a result?
- Solution
  - Increase the `MAX_EFFECTIVE_BALANCE`.
  - Allow validator index merging.
  - Enable custom ceilings and/or EL partial withdrawals.
  - Modify the slashing penalty. (maybe?)

Outline

- Problem
  - What is `MAX_EFFECTIVE_BALANCE`?
  - What is the partial withdrawals sweep?
  - What happens as a result?
- Solution
  - Increase the `MAX_EFFECTIVE_BALANCE`.
  - Allow validator index merging.
  - Enable custom ceilings and/or EL partial withdrawals.
  - Modify the slashing penalty. (maybe?)
- Results
  - Network stability.
  - Autocompounding for solo-stakers.
  - Path towards Single Slot Finality.

Problem

What is `MAX_EFFECTIVE_BALANCE`? (abbr. `MAXEB`)

Gwei values

Name	Value
`MIN_DEPOSIT_AMOUNT`	`Gwei(2**0 * 10**9)` (= 1,000,000,000)
`MAX_EFFECTIVE_BALANCE`	`Gwei(2**5 * 10**9)` (= 32,000,000,000)
`EFFECTIVE_BALANCE_INCREMENT`	`Gwei(2**0 * 10**9)` (= 1,000,000,000)

https://github.com/ethereum/consensus-specs/blob/dev/specs/phase0/beacon-chain.md

Problem

What is MAX_EFFECTIVE_BALANCE? (abbr. MAXEB)

Gwei values

Name	Value
MIN_DEPOSIT_AMOUNT	Gwei(2**0 * 10**9) (= 1,000,000,000)
MAX_EFFECTIVE_BALANCE	Gwei(2**5 * 10**9) (= 32,000,000,000)
EFFECTIVE_BALANCE_INCREMENT	Gwei(2**0 * 10**9) (= 1,000,000,000)

- Upper bound on the "effective balance" of a validator.

https://github.com/ethereum/consensus-specs/blob/dev/specs/phase0/beacon-chain.md

Problem

What is MAX_EFFECTIVE_BALANCE? (abbr. MAXEB)

Gwei values

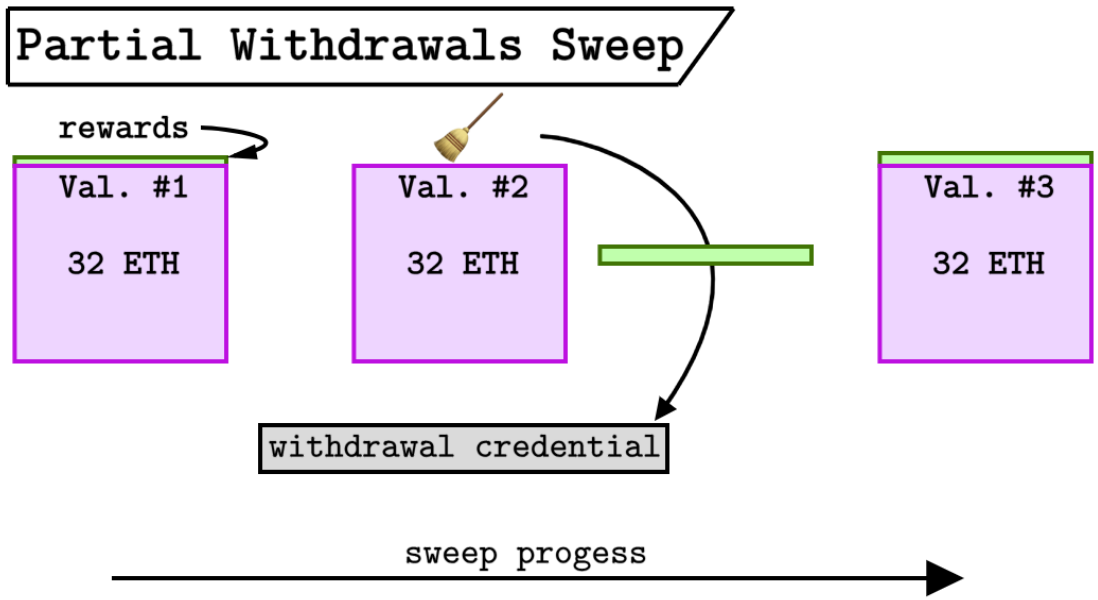
Name	Value
MIN_DEPOSIT_AMOUNT	Gwei(2**0 * 10**9) (= 1,000,000,000)
MAX_EFFECTIVE_BALANCE	Gwei(2**5 * 10**9) (= 32,000,000,000)
EFFECTIVE_BALANCE_INCREMENT	Gwei(2**0 * 10**9) (= 1,000,000,000)

- Upper bound on the "effective balance" of a validator.
- The minimum balance to become a validator *is the same as* the MAXEB (32 ETH)

https://github.com/ethereum/consensus-specs/blob/dev/specs/phase0/beacon-chain.md

Problem

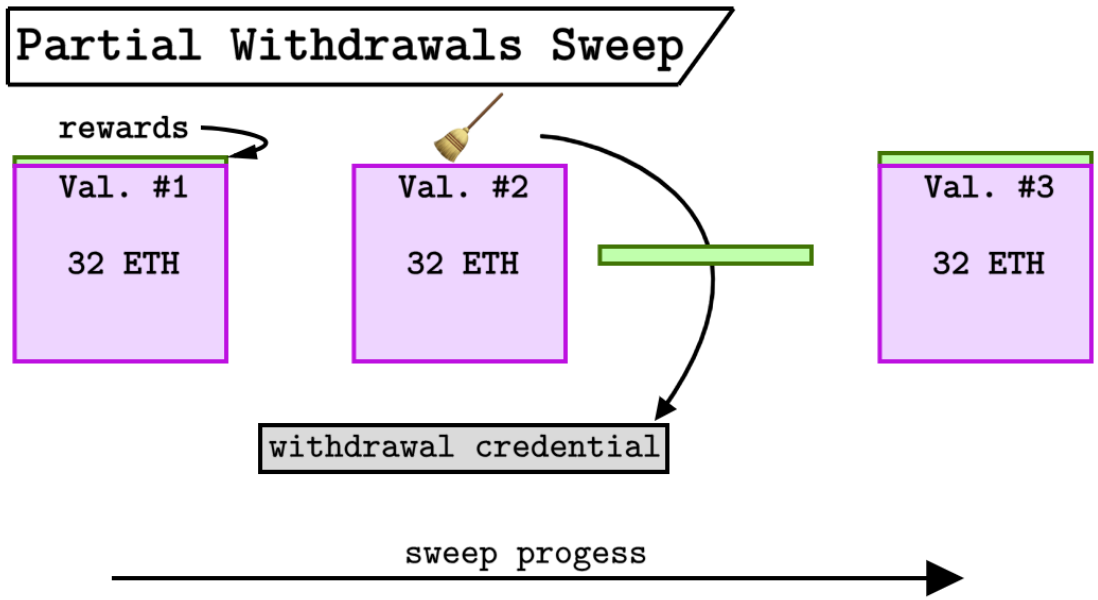
What is the partial withdrawals sweep?



https://mainnet.beaconcha.in/validator/0x876b...#withdrawals

Problem

What is the partial withdrawals sweep?

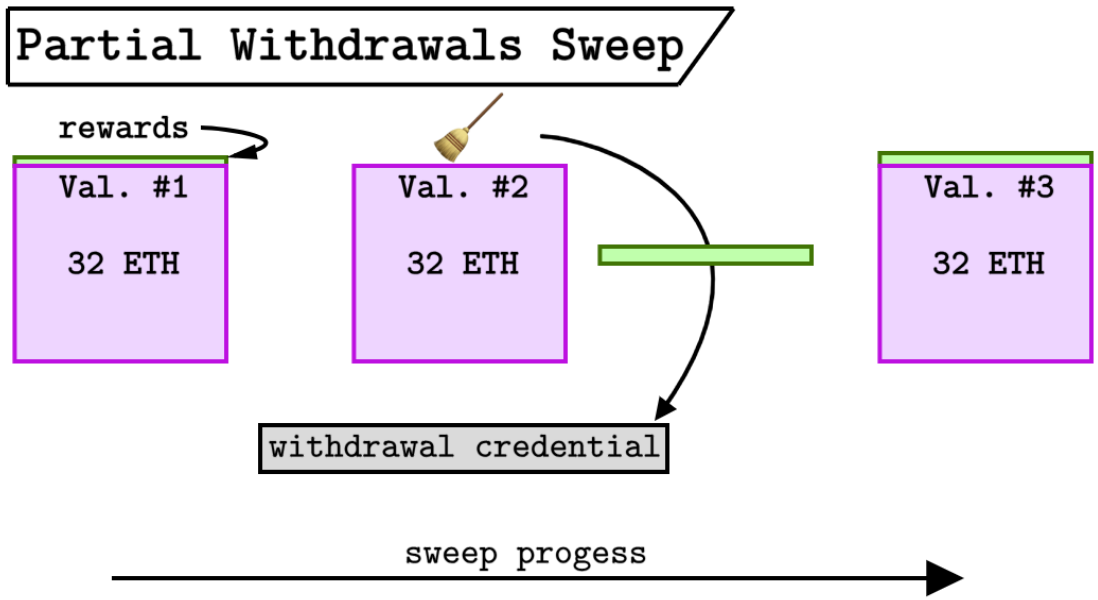


- Removes any excess balance.

https://mainnet.beaconcha.in/validator/0x876b...#withdrawals

Problem

What is the partial withdrawals sweep?



- Removes any excess balance.
- Sends the rewards to a "withdrawal credential".

https://mainnet.beaconcha.in/validator/0x876b...#withdrawals

Problem

What is the partial withdrawals sweep?

Epoch	Slot	Time	Recipient Address	Amount
~ 242,359	~ 7,755,513	~ in 18 hrs 22 mins	0x3d84a4...0e36C8	0.014990 ETH
240,703	7,702,503	6 days 14 hrs ago	0x3d84a4...0e36C8	0.016229 ETH
239,041	7,649,321	13 days 23 hrs ago	0x3d84a4...0e36C8	0.016900 ETH
237,386	7,596,368	21 days 8 hrs ago	0x3d84a4...0e36C8	0.016822 ETH
235,743	7,543,798	28 days 15 hrs ago	0x3d84a4...0e36C8	0.016517 ETH
234,125	7,492,007	35 days 19 hrs ago	0x3d84a4...0e36C8	0.016449 ETH

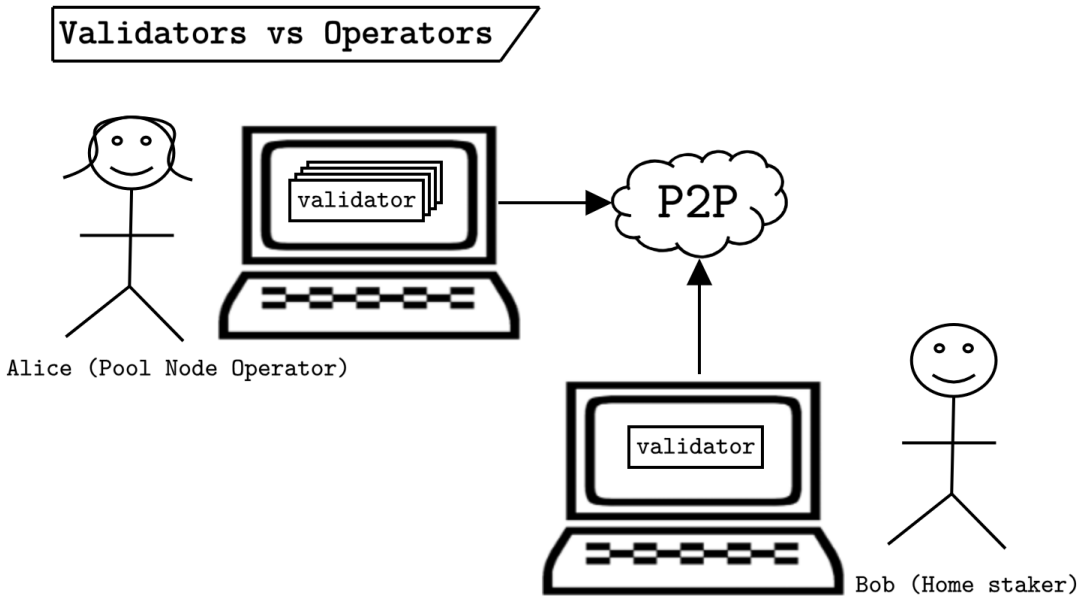
- Removes any excess balance.
- Sends the rewards to a "withdrawal credential".
- It takes about 6 days for the sweep to finish one round.

---

https://mainnet.beaconcha.in/validator/0x876b...#withdrawals

Problem

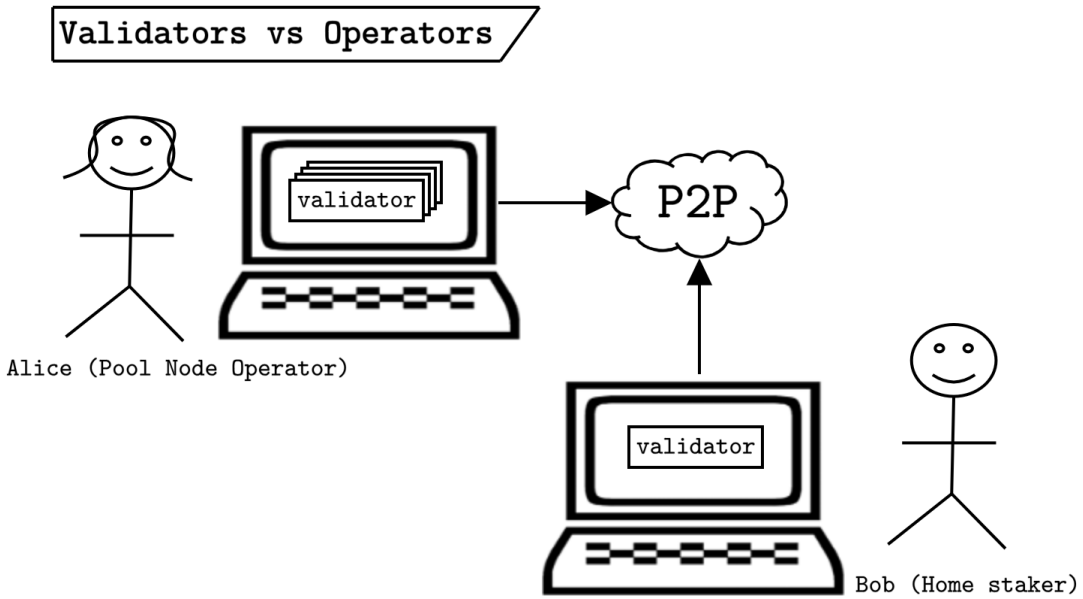
What happens as a result?



https://www.validatorqueue.com/

Problem

What happens as a result?

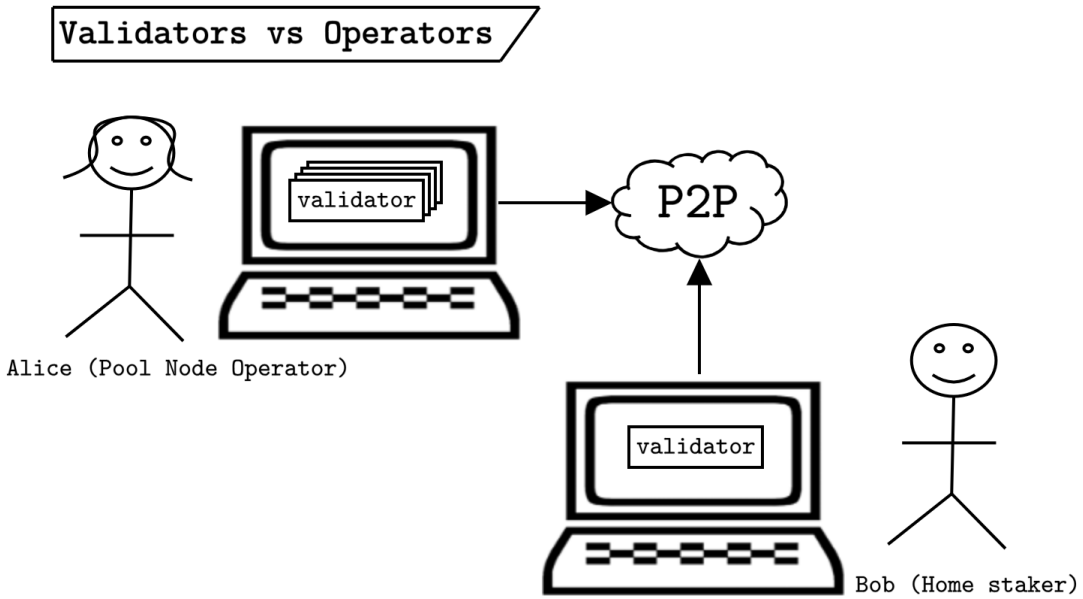


- Highly redundant work.

https://www.validatorqueue.com/

Problem

What happens as a result?

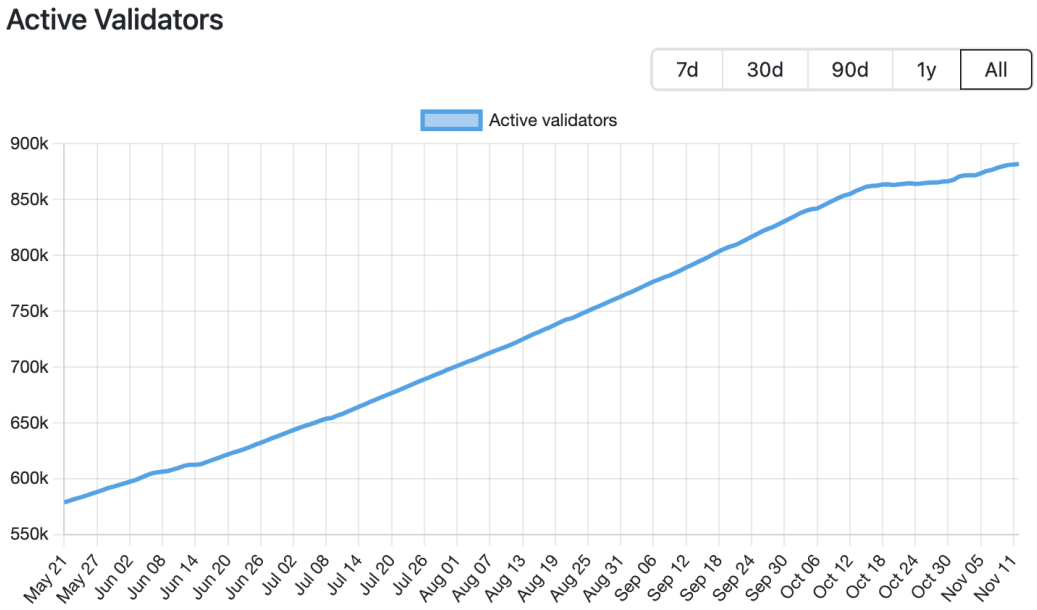


- Highly redundant work.
- Huge number of validators.

https://www.validatorqueue.com/

Problem

What happens as a result?

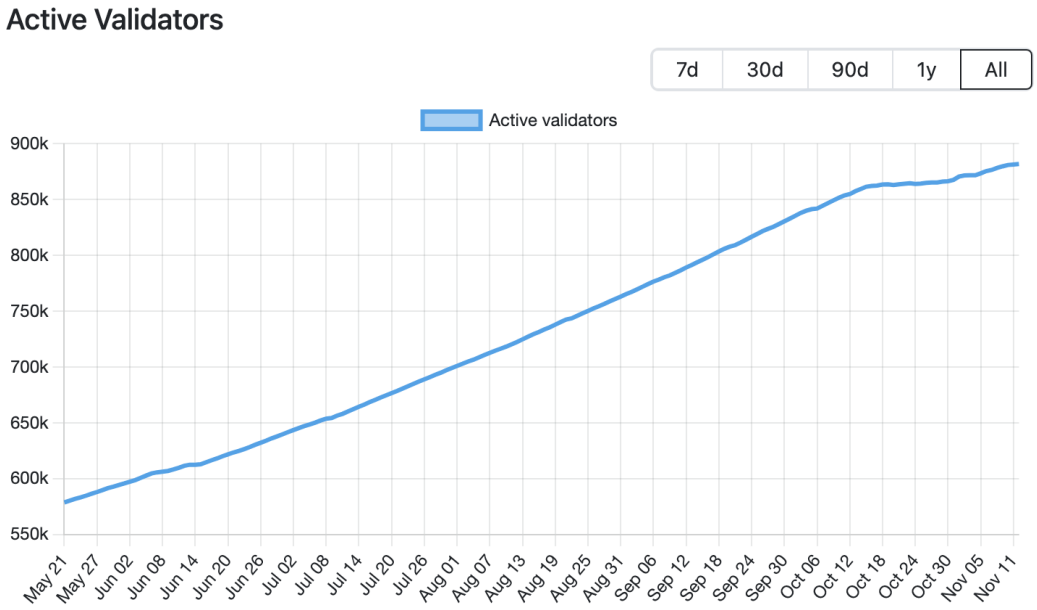


- Highly redundant work.
- Huge number of validators.

https://www.validatorqueue.com/

Problem

What happens as a result?



- Highly redundant work.
- Huge number of validators.
- This impacts the performance of the consensus clients...

https://www.validatorqueue.com/

Problem

What happens as a result? part 2

bigboi-beaconchain-test-1

Details:

- 2.1M validators total
- 420 nodes
- 16c/32Gb each machine
- 5k keys/node
- {Prysm,Lighthouse}-{Geth,Nethermind} = 1M validators together, equally split
- 28% = prysm, 28% = lighthouse, 14% each - all others

Overall health:

Epoch 4:
Proposals: 26/32 (81.25%)
Attestations: 801006/2100000 (38.14%)
Source timely: 773796/2100000 (36.85%)
Target correct: 800764/2100000 (38.13%)
Target timely: 800764/2100000 (38.13%)
Head correct: 760119/2100000 (36.20%)
Head timely: 592021/2100000 (28.19%)
Sync committees: 8674/13312 (65.16%)

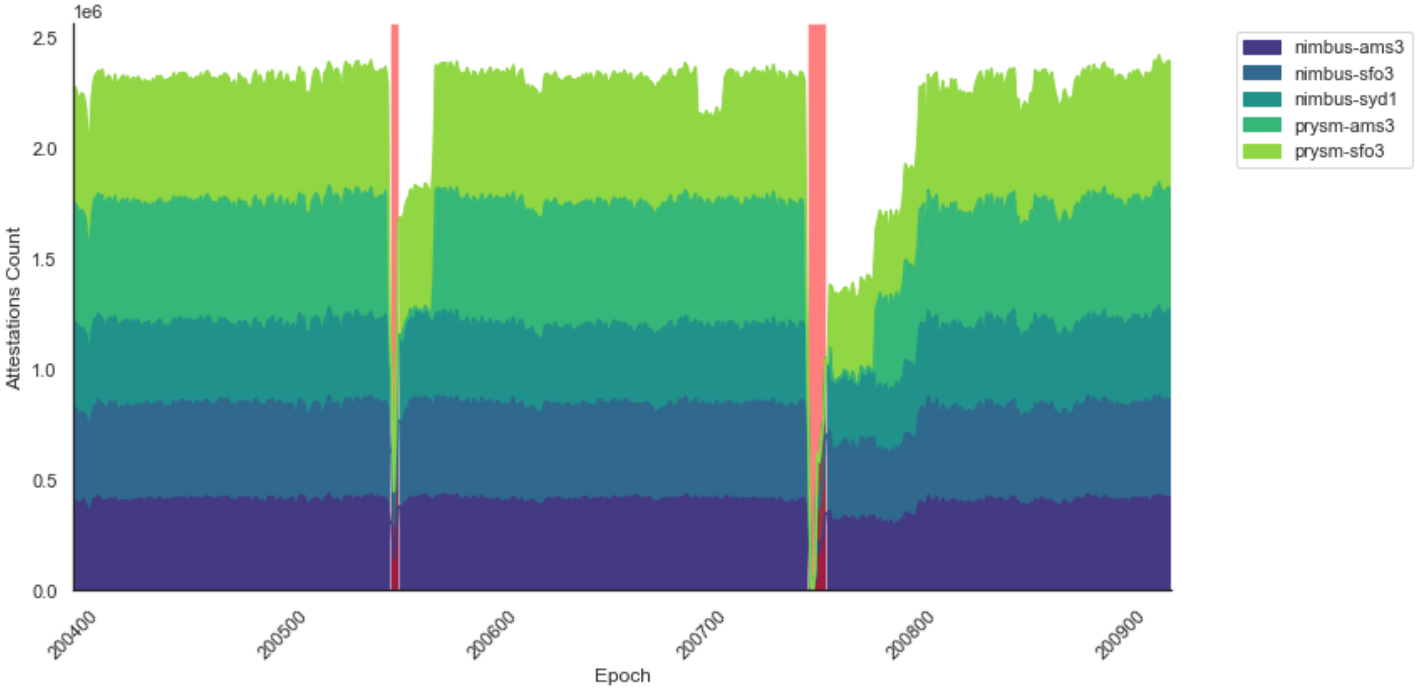
---

https://notes.ethereum.org/@parithosh/bigboi-beaconchain-test-1

https://ethresear.ch/t/cascading-network-effects-on-ethereums-finality/15871

Problem

What happens as a result? part 2

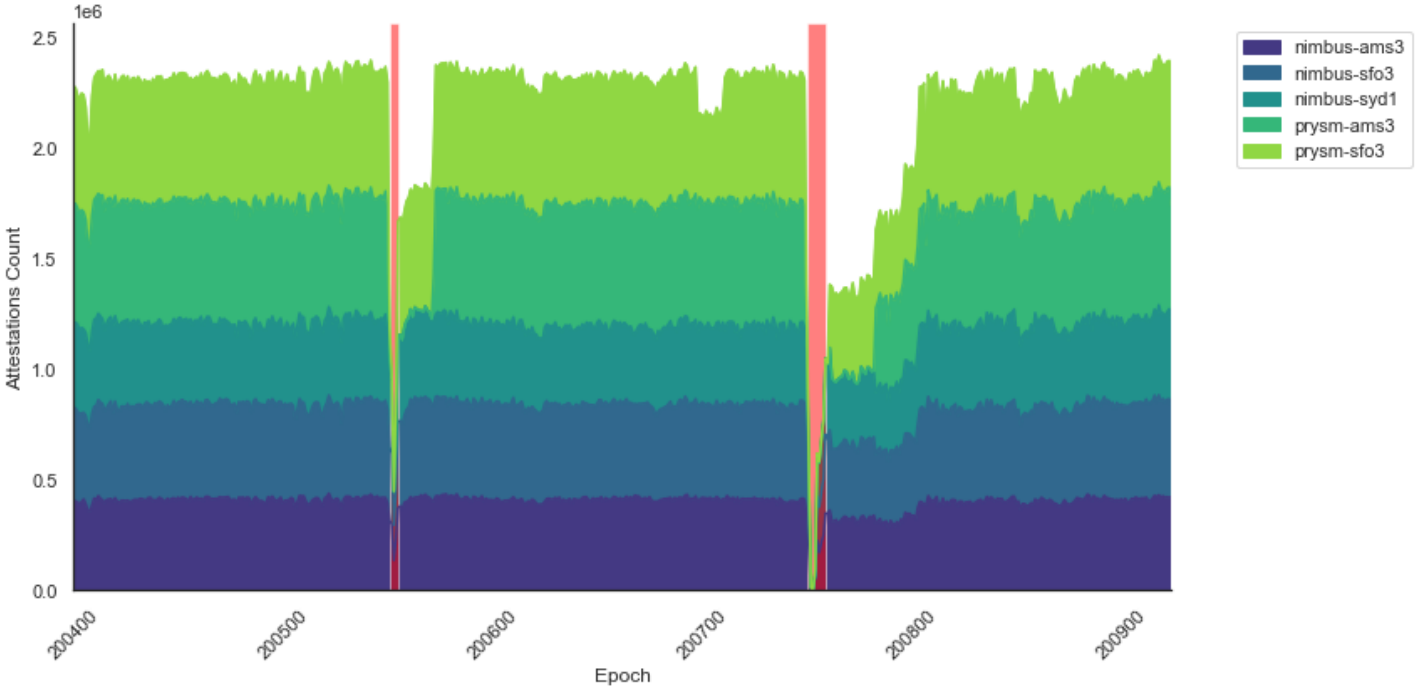


https://notes.ethereum.org/@parithosh/bigboi-beaconchain-test-1

https://ethresear.ch/t/cascading-network-effects-on-ethereums-finality/15871

Problem

What happens as a result? part 2



- Bloated validator set $\implies$ large beacon state, long signature aggregations, and more p2p networking overhead.

---

https://notes.ethereum.org/@parithosh/bigboi-beaconchain-test-1

https://ethresear.ch/t/cascading-network-effects-on-ethereums-finality/15871

Solution

- well... increase the MAX_EFFECTIVE_BALANCE.

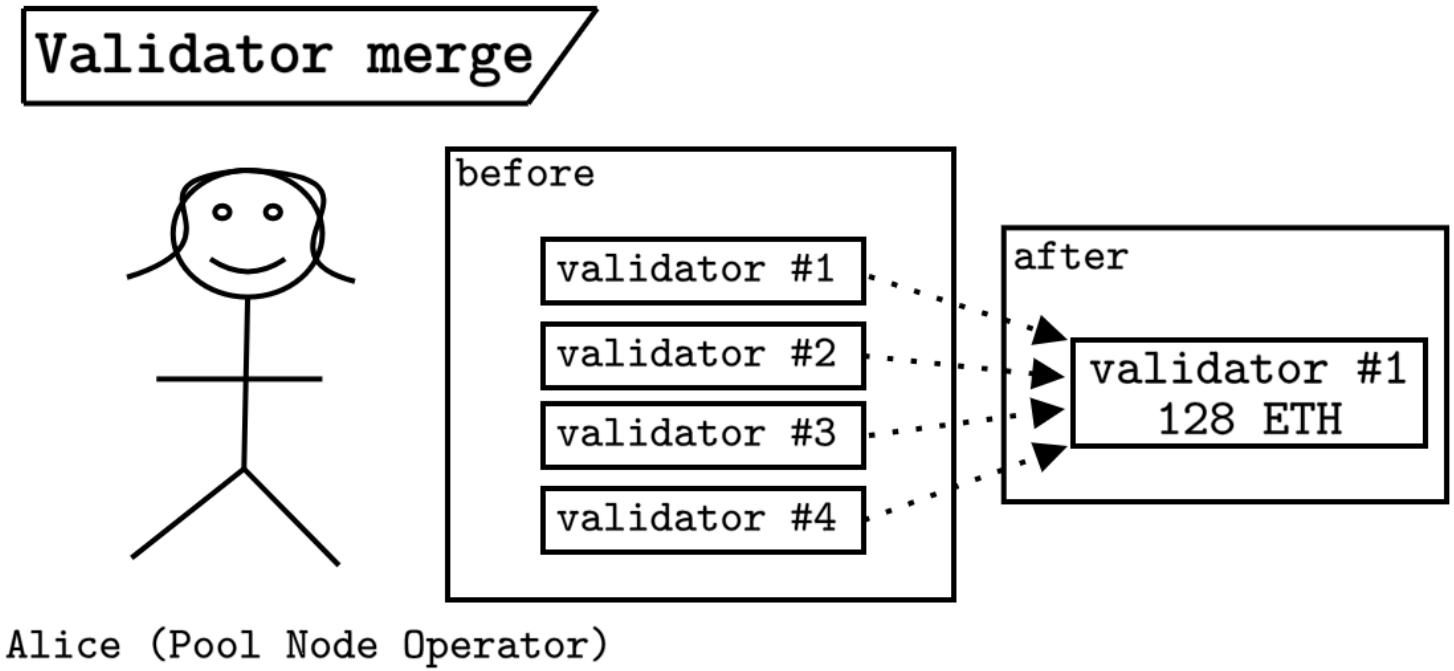
Solution

- well... increase the MAX_EFFECTIVE_BALANCE.

```
194  + MAX_EFFECTIVE_BALANCE = Gwei(2048000000000)
195  + MIN_ACTIVATION_BALANCE = Gwei(32000000000)
```

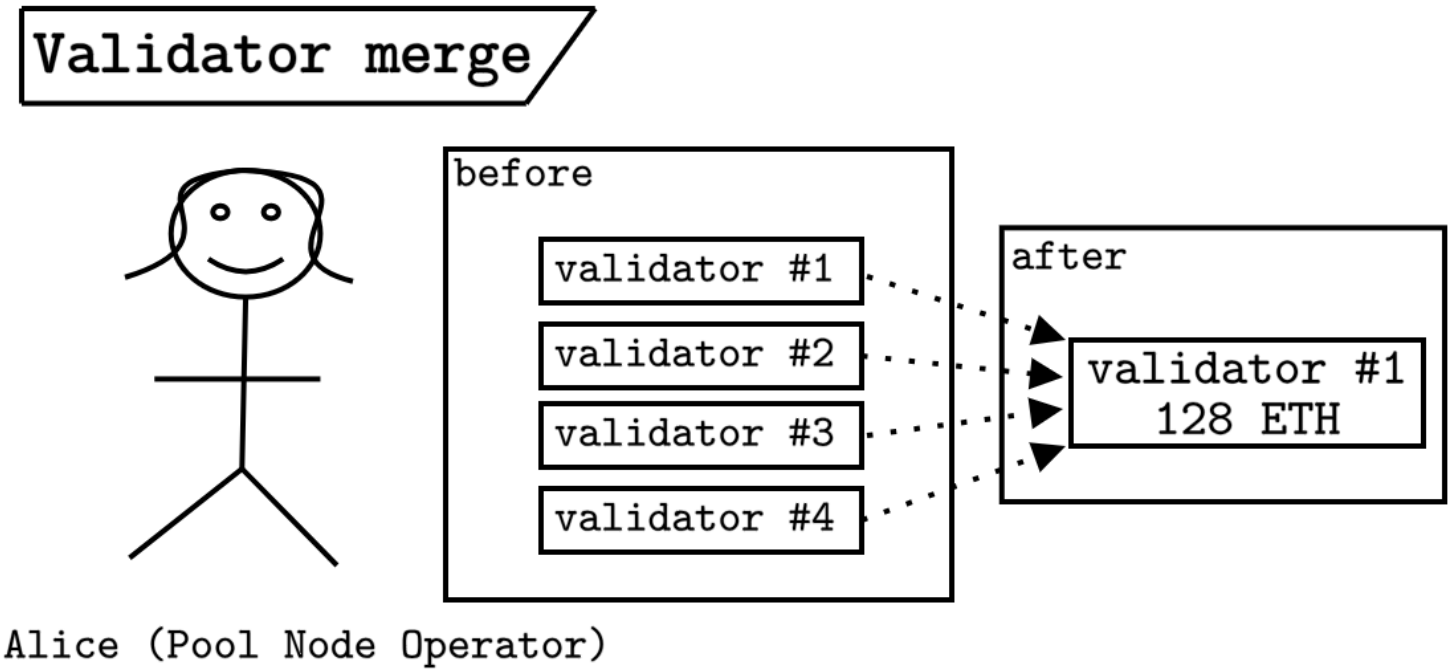
Solution

Allow validator index merging



Solution

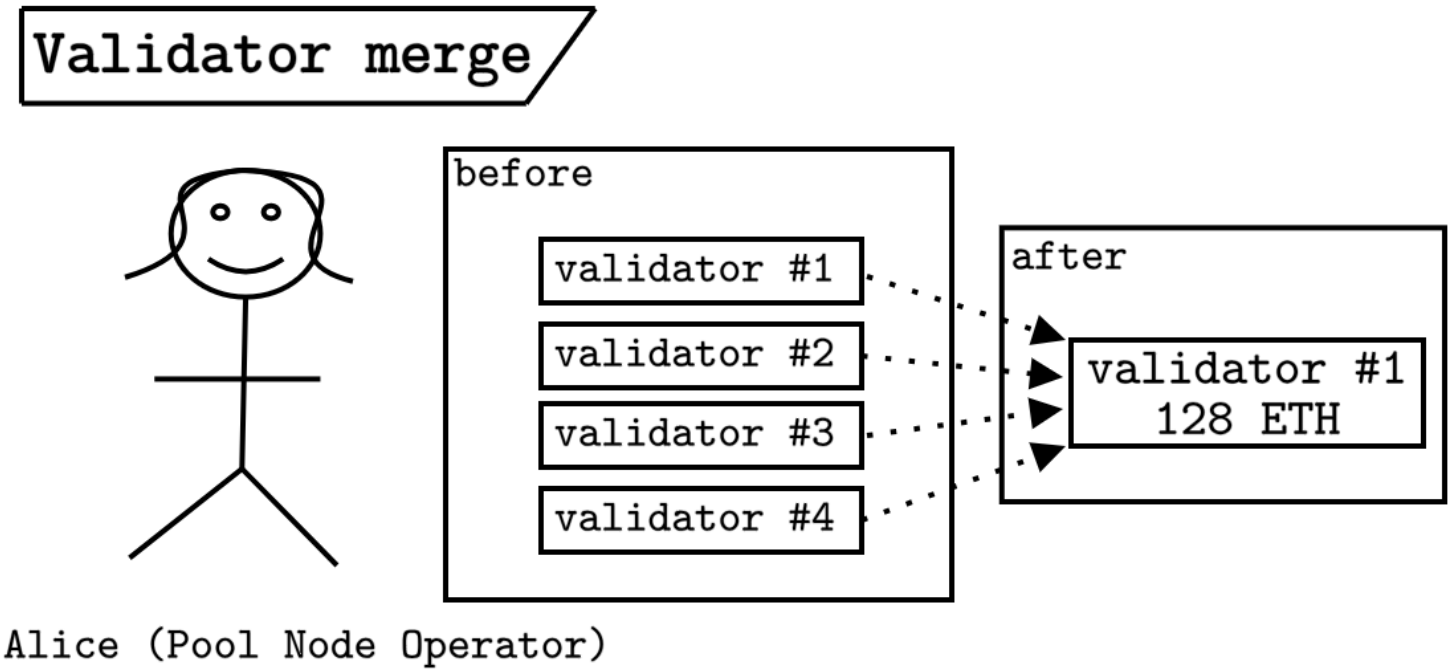
Allow validator index merging



- Need the participation of staking pools!

Solution

Allow validator index merging



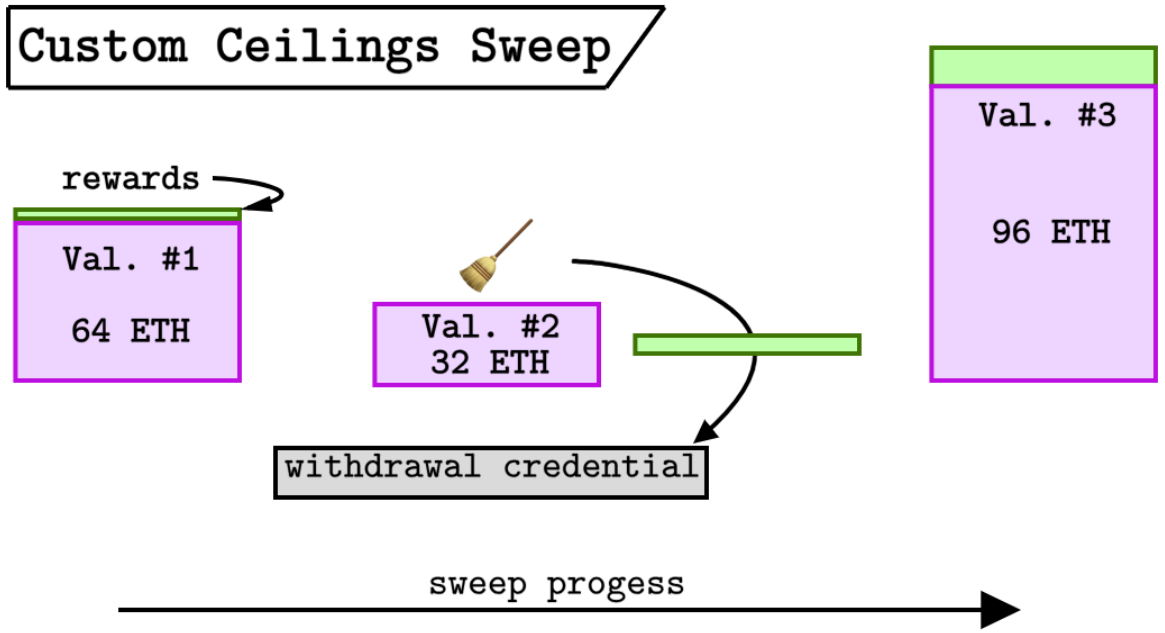
- Need the participation of staking pools!
- Merge validators without exiting the consensus layer.

Solution

Enable custom ceilings and/or EL partial withdrawals

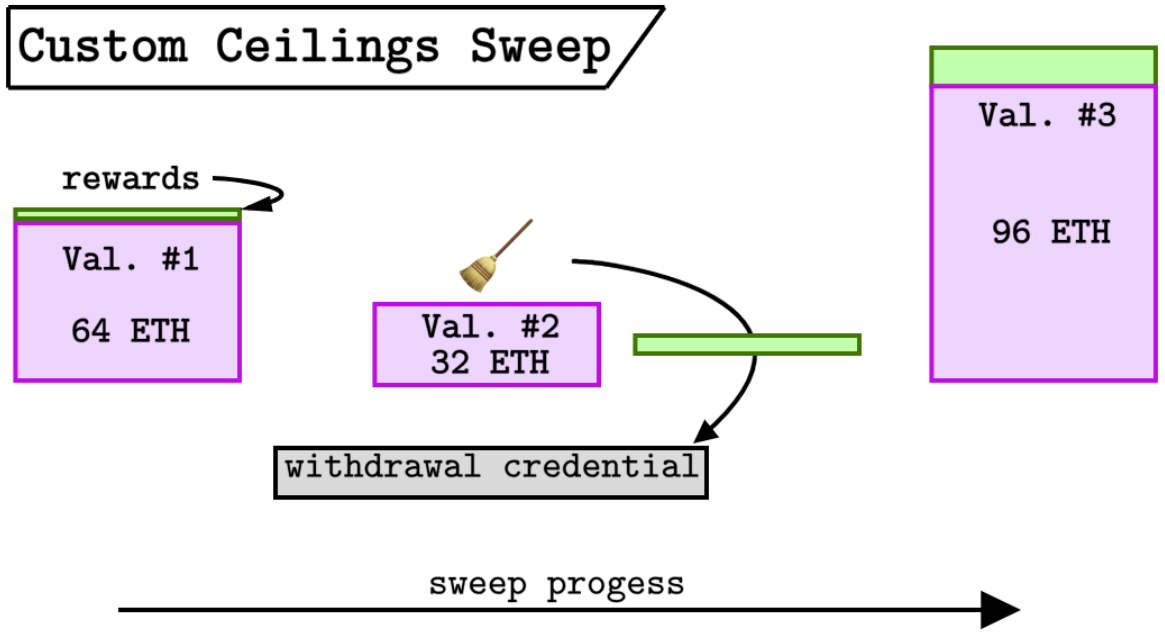
Solution

Enable custom ceilings and/or EL partial withdrawals



Solution

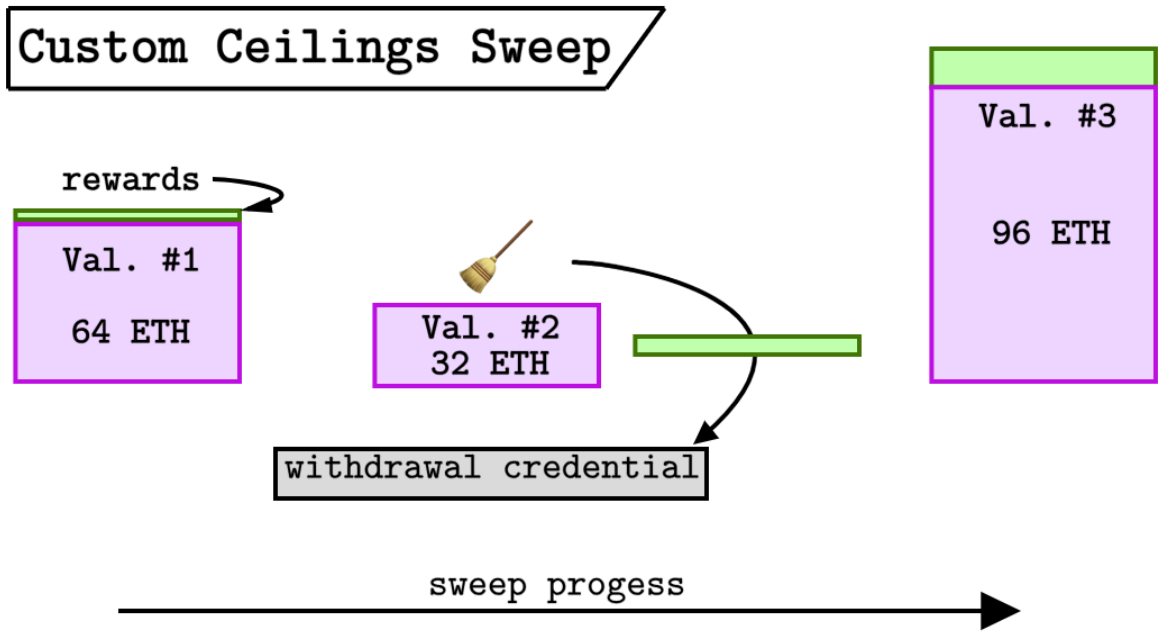
Enable custom ceilings and/or EL partial withdrawals



- Each validator could set their own balance ceiling.

Solution

Enable custom ceilings and/or EL partial withdrawals



- Each validator could set their own balance ceiling.
- Alternatively, allow execution layer partial withdrawals (extend EIP-7002).

Add EIP: Execution layer triggerable exits 104

ethereum:master ← djrtwo:el-exits

opened May 9, 2023 djrtwo +369 -0

Solution

Modify the slashing penatly (maybe?)

$$\text{Initial Penalty} = \frac{EB^{\text{pow}}}{32}$$

https://ethresear.ch/t/slashing-penalty-analysis-eip-7251/16509

Solution

Modify the slashing penatly (maybe?)

$$\text{Initial Penalty} = \frac{EB^{\text{pow}}}{32}$$

- Currently, pow $= 1$, so slashing is 1 ETH.

https://ethresear.ch/t/slashing-penalty-analysis-eip-7251/16509

Solution

Modify the slashing penatly (maybe?)

$$\text{Initial Penalty} = \frac{EB^{\text{pow}}}{32}$$

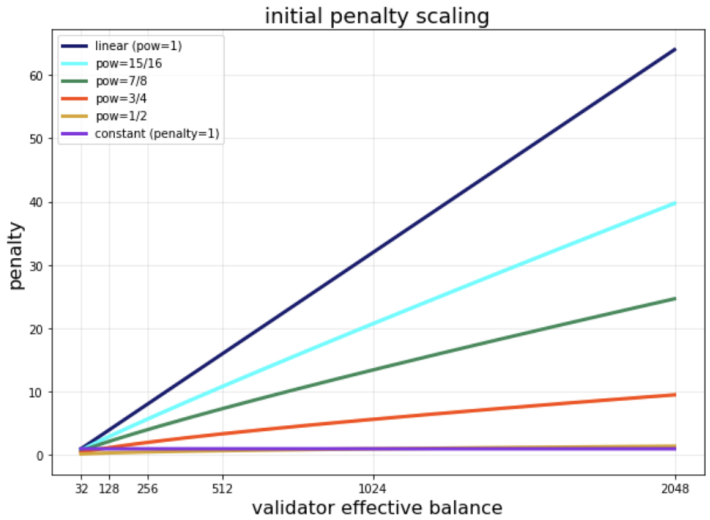
- Currently, pow $= 1$, so slashing is 1 ETH.
- Linear scaling of the penalty is extremely punitive.

https://ethresear.ch/t/slashing-penalty-analysis-eip-7251/16509

Solution

Modify the slashing penatly (maybe?)

$$\text{Initial Penalty} = \frac{EB^{\text{pow}}}{32}$$



- Currently, pow $= 1$, so slashing is 1 ETH.
- Linear scaling of the penalty is extremely punitive.
- We could scale the initial penalty sub-linearly.

https://ethresear.ch/t/slashing-penalty-analysis-eip-7251/16509

Results

- Clean up historical tech debt.

https://notes.ethereum.org/@vbuterin/single_slot_finality

https://ethresear.ch/t/a-simple-single-slot-finality-protocol/14920

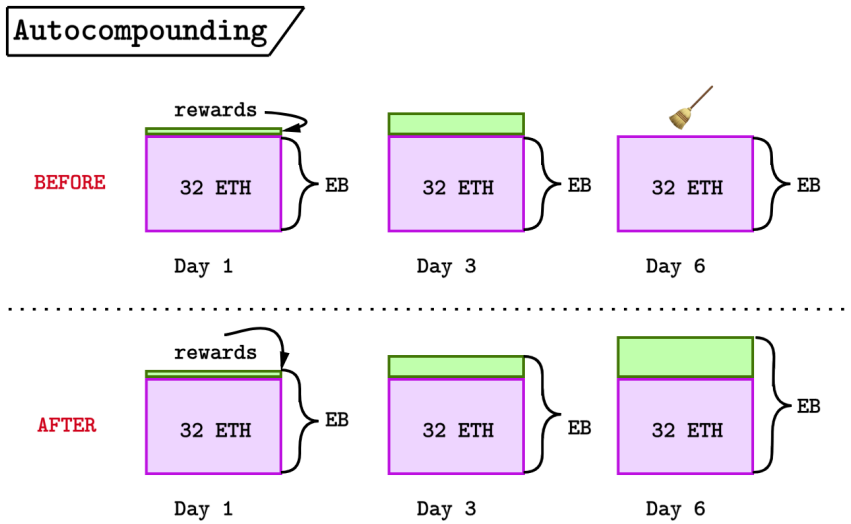
Results

- Clean up historical tech debt.
- Improve network stability.

https://notes.ethereum.org/@vbuterin/single_slot_finality

https://ethresear.ch/t/a-simple-single-slot-finality-protocol/14920

Results

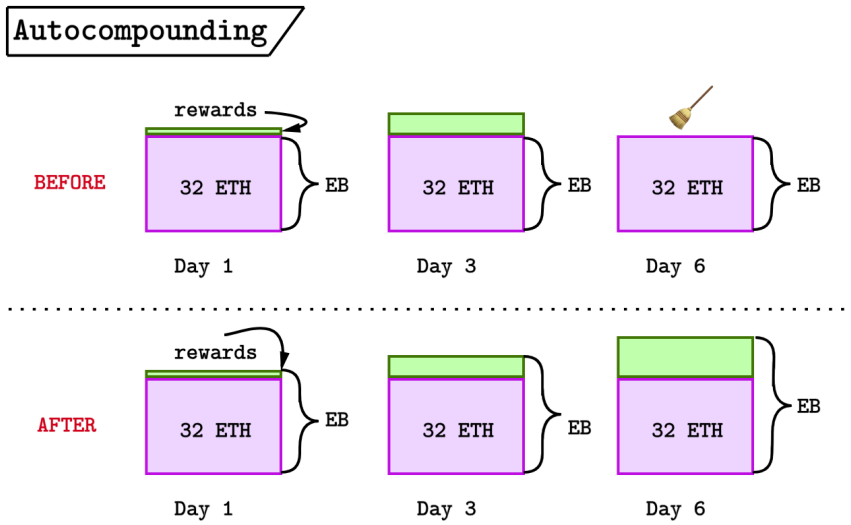


- Clean up historical tech debt.
- Improve network stability.
- Enable autocompounding and flexible balances for solo-stakers.

https://notes.ethereum.org/@vbuterin/single_slot_finality

https://ethresear.ch/t/a-simple-single-slot-finality-protocol/14920

Results



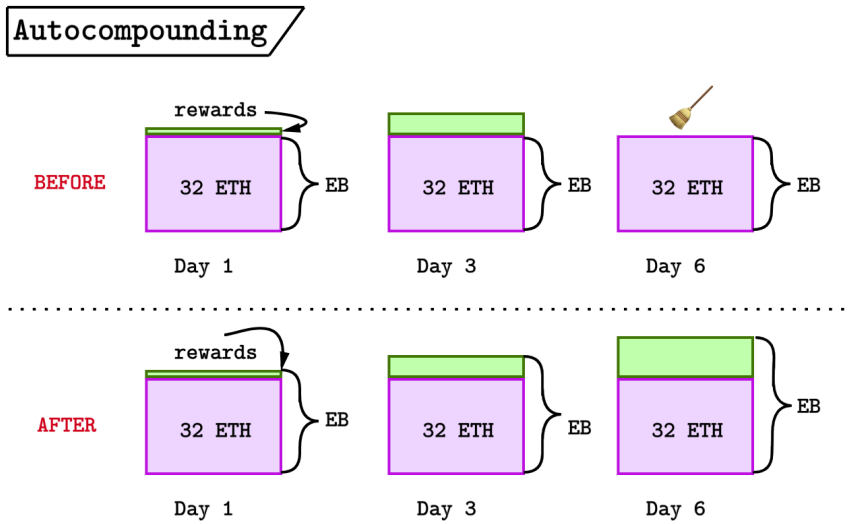
- Clean up historical tech debt.
- Improve network stability.
- Enable autocompounding and flexible balances for solo-stakers.
- Open the path to Single Slot Finality.

---

https://notes.ethereum.org/@vbuterin/single_slot_finality

https://ethresear.ch/t/a-simple-single-slot-finality-protocol/14920

Results



- Clean up historical tech debt.
- Improve network stability.
- Enable autocompounding and flexible balances for solo-stakers.
- Open the path to Single Slot Finality.
- Aim to decrease the `MIN_ACTIVATION_BALANCE`. (ambitious)

---

https://notes.ethereum.org/@vbuterin/single_slot_finality

https://ethresear.ch/t/a-simple-single-slot-finality-protocol/14920

thanks! :-)

read more here ↑

https://gist.github.com/michaelneuder/cafabcfcfcccc45e44ab9d6b1c7b4e1d