# Proposer-Builder Separation in Ethereum (alt. "ePBS – the infinite buffet")


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UNIversity – sept 20, 2023

# Outline

- What is Proposer-Builder Separation?
- PBS of today – `mev-boost`
- Other out-of-protocol options
  - optimistic relays
  - `pepc-boost`
  - `mev-boost+`
- Enshrining PBS
  - Reasons to enshrine
  - Two-slot PBS
  - Payload-Timeliness committee
  - PEPC
- Relays in a post-ePBS world
- Open questions

# What is Proposer-Builder Separation

## Etymology

**Proposer/block builder separation-friendly fee market designs**

Economics

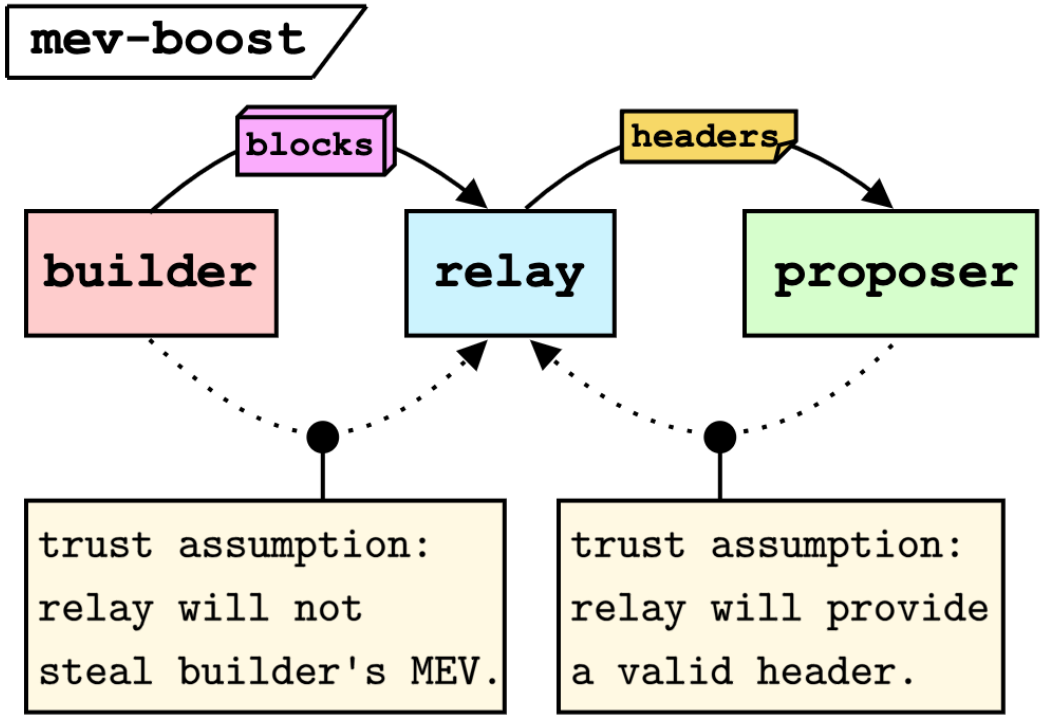
vbuterin Jun '21

- Proposers = validators selected to propose a block during a slot (unsophisticated)
- Builders = participants capable of constructing high-value blocks (sophisticated)
- Decouple these two roles to avoid centralization pressures

So what's the result? **Block *production* is centralized, block *validation* is trustless and highly decentralized, and censorship is still prevented.**

# PBS of today – mev-boost

## out-of-protocol PBS




- Relay serves as a mutually trusted auctioneer
- Validators run sidecar software to interact with relays
- Massive adoption: 95% of blocks are built using mev-boost

# PBS of today – mev-boost

relayscan.io

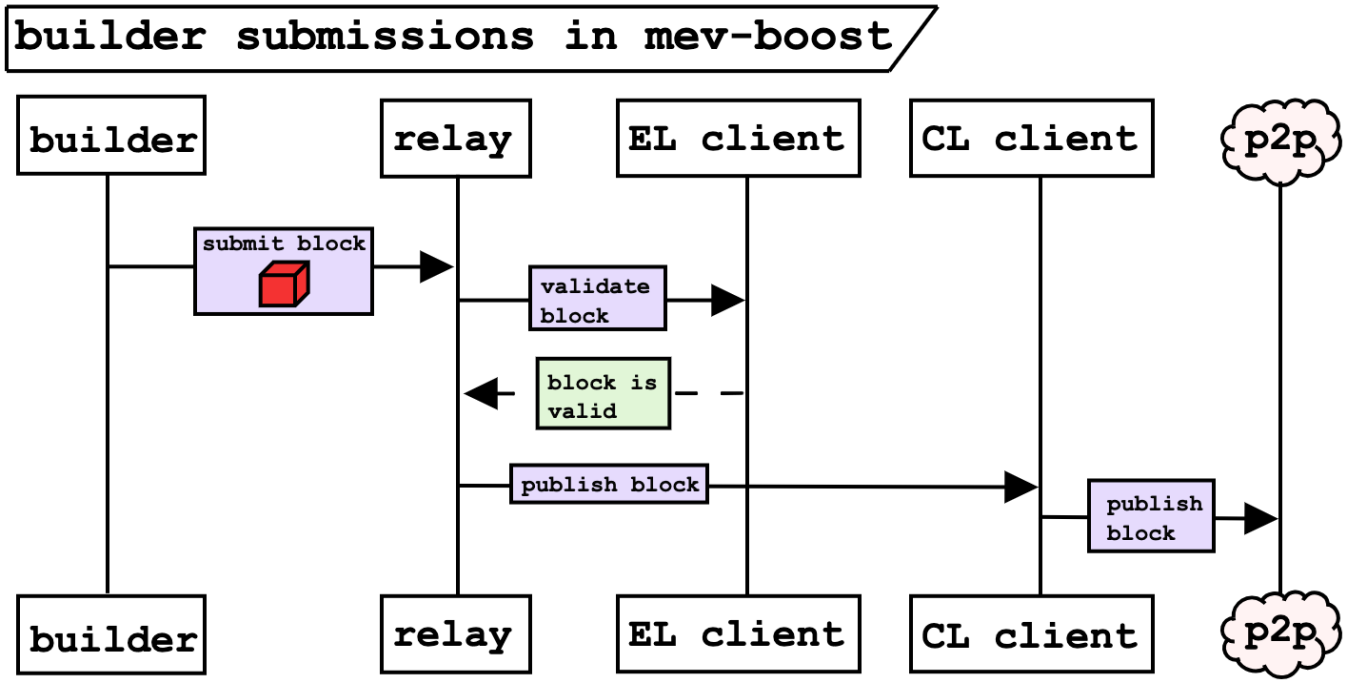
| Relay | Payloads | Percent |
|---|---|---|
| relay.ultrasound.money | 2,975 | 24.50 % |
| boost-relay.flashbots.net | 2,349 | 19.34 % |
| bloxroute.max-profit.blxrbdn.com | 2,264 | 18.64 % |
| agnostic-relay.net | 1,846 | 15.20 % |
| bloxroute.regulated.blxrbdn.com | 1,430 | 11.78 % |
| builder-relay-mainnet.blocknative.com | 1,060 | 8.73 % |
| aestus.live | 204 | 1.68 % |

| Builder (extra_data) | Blocks | Percent |
|---|---|---|
| Titan (titanbuilder.xyz) | 2,085 | 31.02 % |
| beaverbuild.org | 1,661 | 24.71 % |
| rsync-builder.xyz ⓘ | 1,456 | 21.66 % |
| Illuminate Dmocratize Dstribute | 668 | 9.94 % |
| builder0x69 ⓘ | 329 | 4.90 % |
| f1b.io | 118 | 1.76 % |
| Gambit Labs (https://gmbit.co) | 80 | 1.19 % |

- Builders are quite centralized
- Most profitable builders specialize in CEX-DEX arbitrage

# Other out-of-protocol options

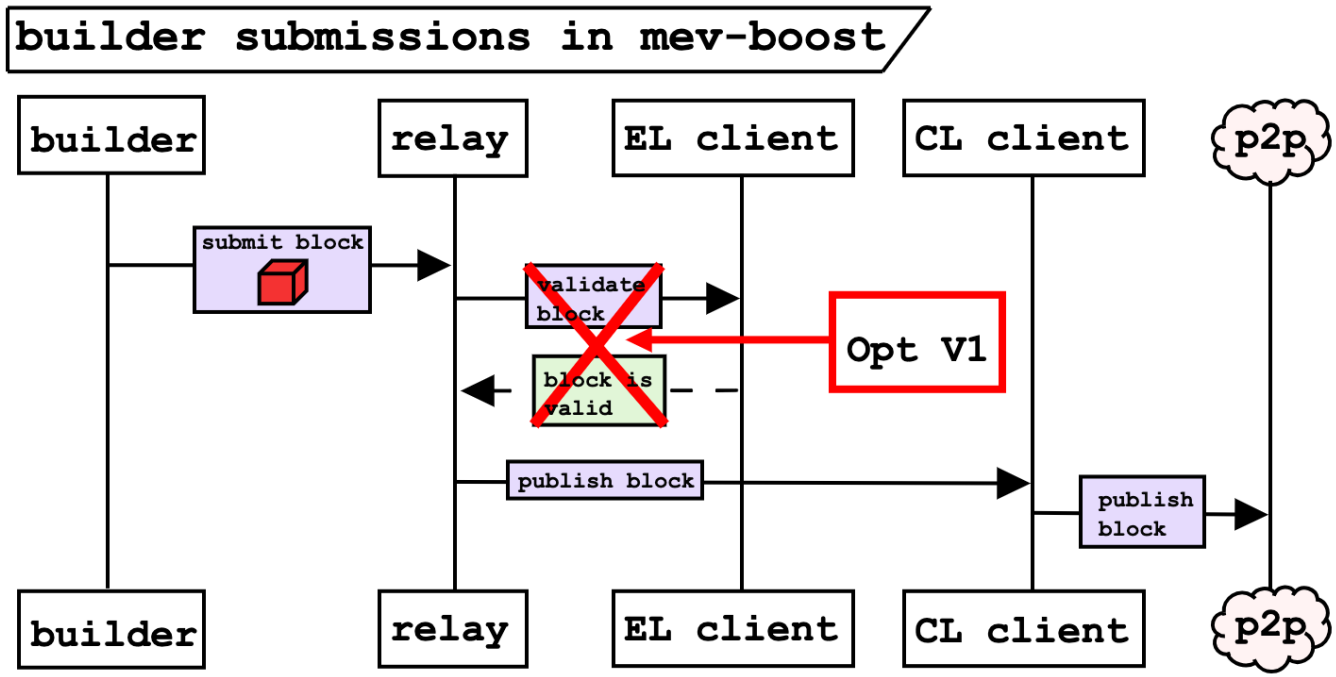
## optimistic relays




- Lots of latency in the block submission flow
- How can we make this more efficient ?

# Other out-of-protocol options

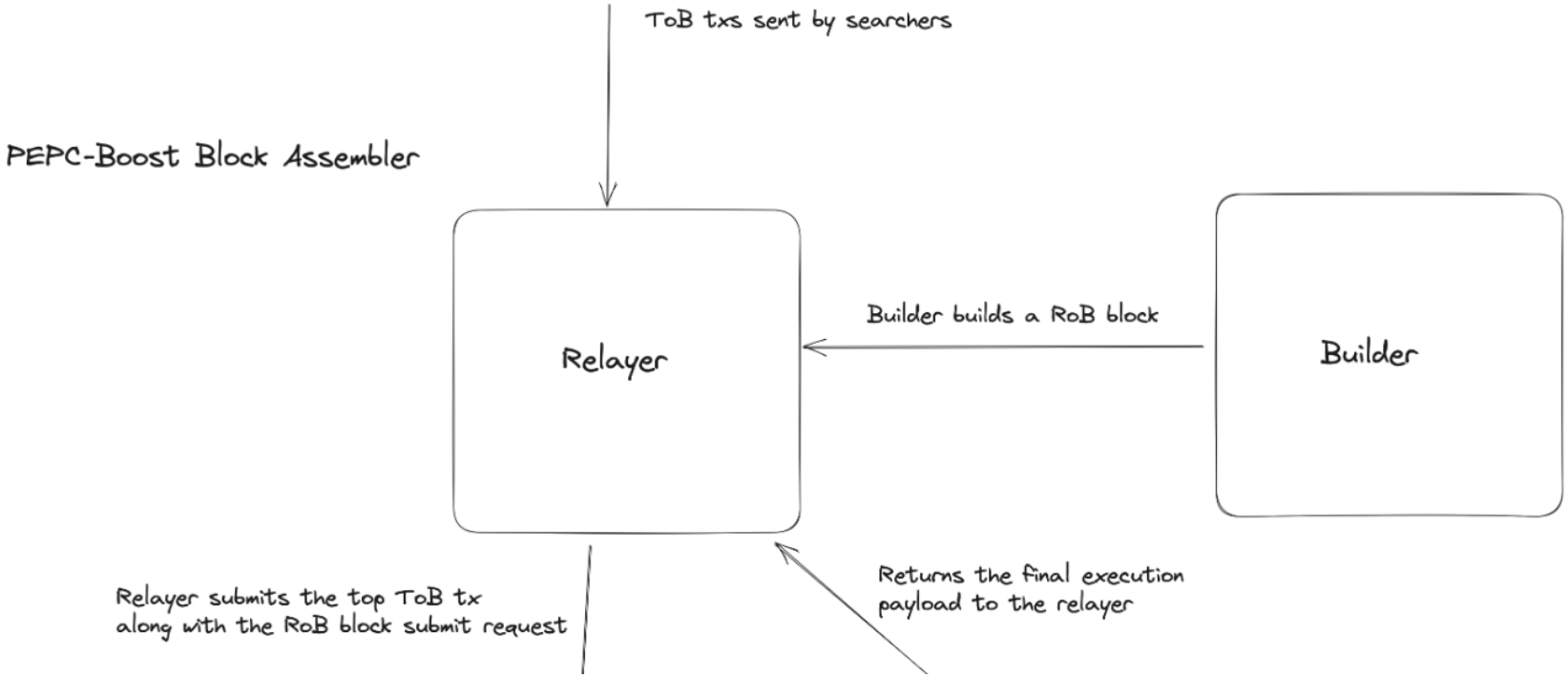
## optimistic relays




- Skip the block simulation
- Immediately saves $\approx 100 - 200$ ms of latency
- Collateralize builders to protect proposers

# Other out-of-protocol options

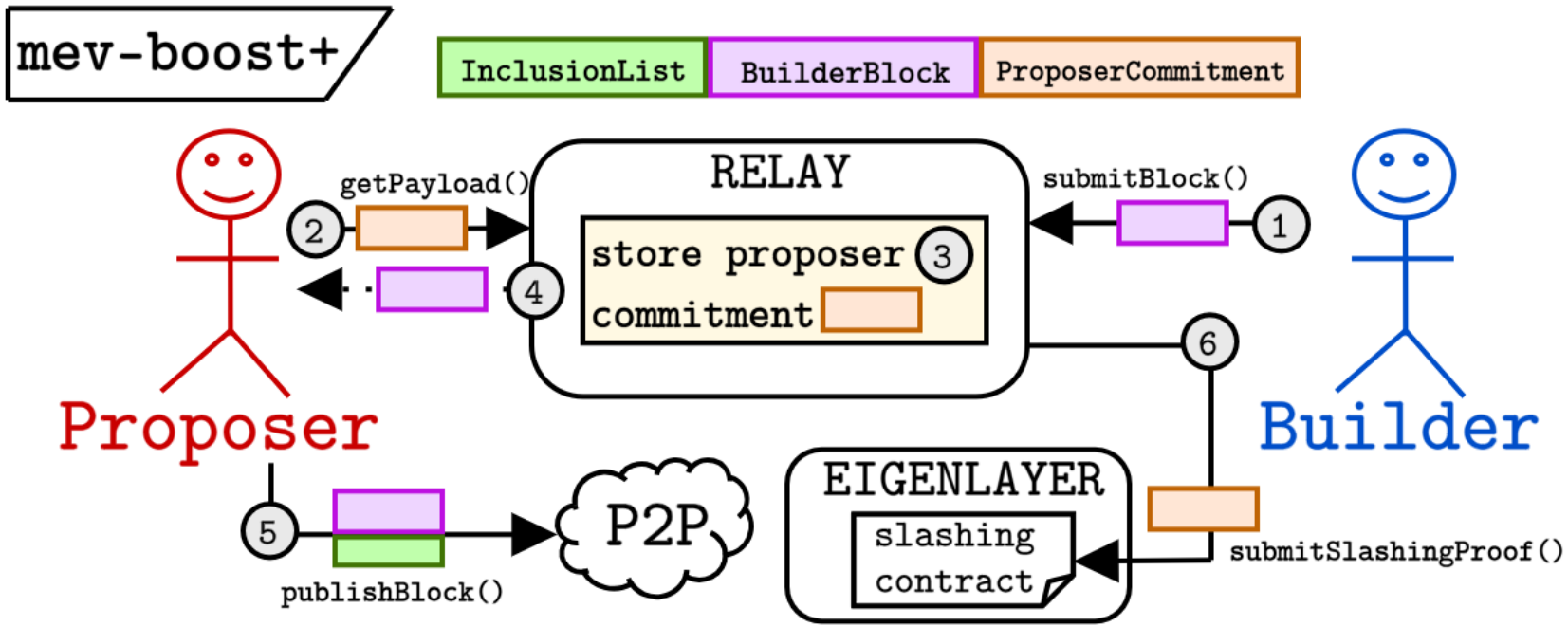
## pepc-boost




- Top-of-Block (ToB) transactions/bundles from searchers
- Rest-of-Block (RoB) from builders
- Relay assembles full block

# Other out-of-protocol options

## mev-boost+

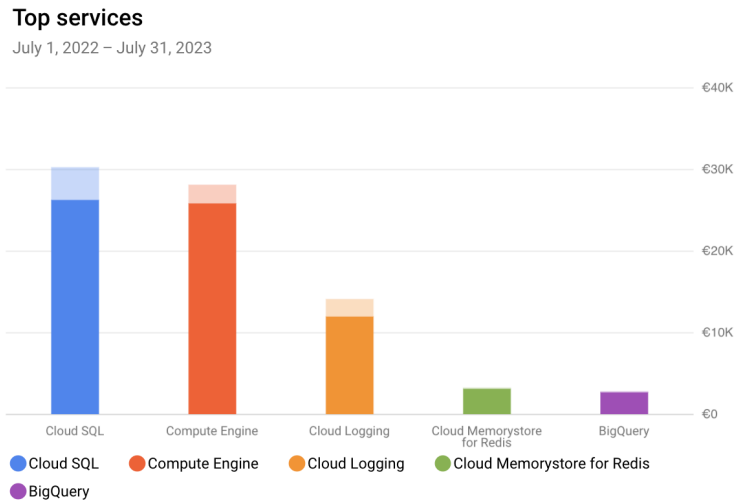



- Leverage restaking to allow proposer to credibly commit to block prefixes
- Returns some agency to the proposer
- Good censorship resistance properties

# Enshrining PBS

## Reasons to enshrine

- Relays erode Ethereum's values
  - Decentralization
  - Censorship resistance
  - Trustlessness
- Out-of-protocol software is brittle
  - Low-Carb Crusader attack
  - Shapella bug
  - Coordination costs
- Relays are expensive
  - No clear funding model
  - Heavily-used public goods infrastructure



# Enshrining PBS

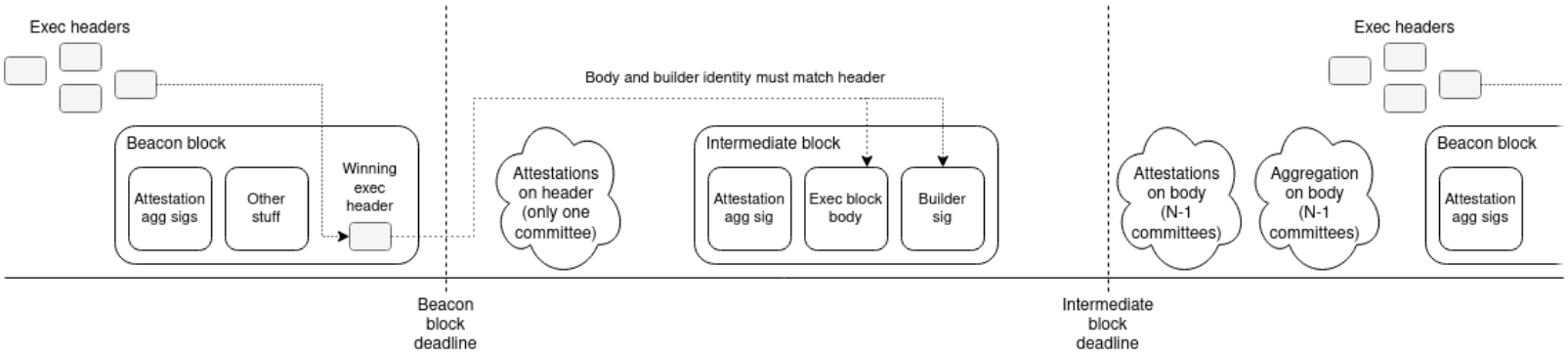
## Two-slot PBS

**Two-slot proposer/builder separation**

Proof-of-Stake ■ proposer-builder-separation

vbuterin 4 Oct '21

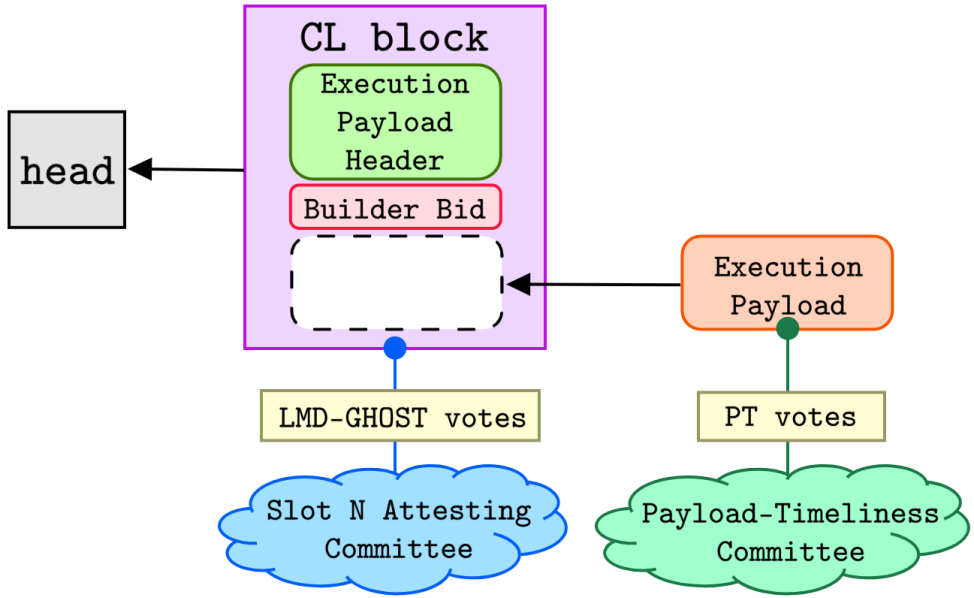
*See previous ideas on this topic: Proposer/block builder separation-friendly fee market designs* 467




- Gives the builder block attestation weight by partitioning the attesting committee
- Weakens the security properties of the consensus layer

# Enshrining PBS

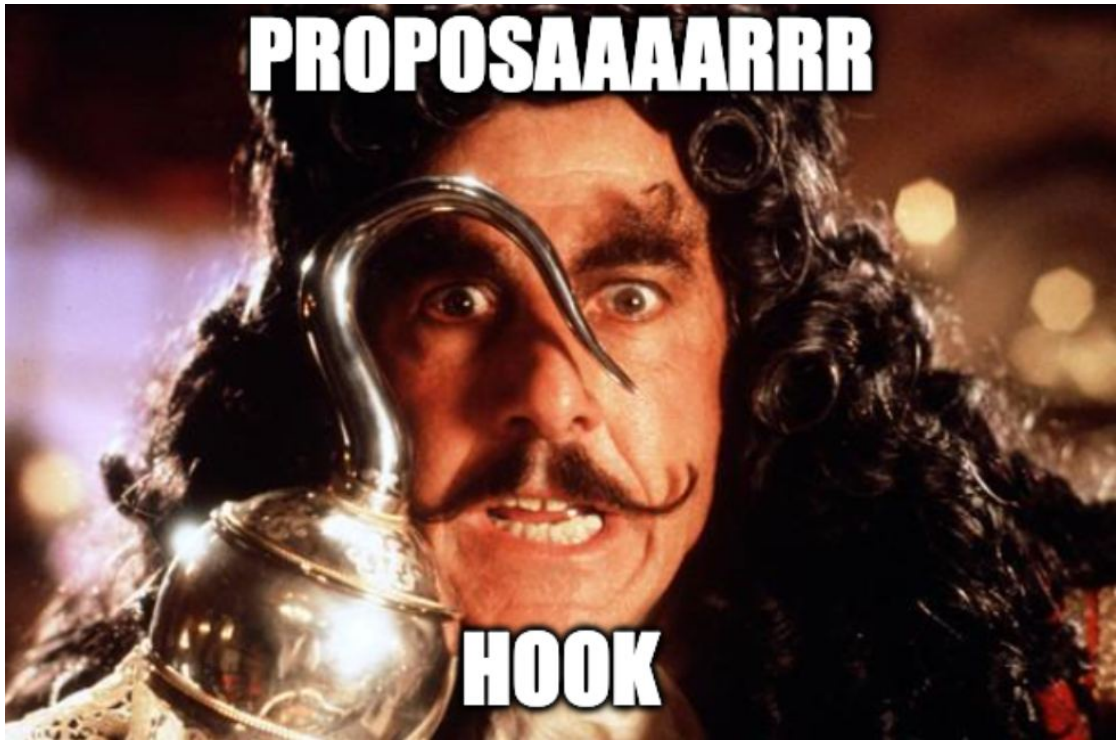
## Payload-Timeliness Committee




- Consensus-layer block is produced *without* any transactions
- Consensus-layer attestations remain the same
- Builder reveals the payload (list of transactions)
- Payload-Timeliness Committee votes on if the payload was published
- Limits the impact on the fork-choice rule

# Enshrining PBS

## PEPC




- Allow the proposer to credibly commit to constraints on their block through the protocol
- Similar to EigenLayer, but enforced by consensus through block validity conditions
- Allows "heterogeneous" commitments from proposers

# Relays in a post-ePBS world


- The nature of latency and MEV $\implies$ relays will probably still exist in a post-ePBS world
- Relays can provide "extra-protocol" services (e.g., payment flexibility, better latency, cancellations, bid privacy)
- This presents some fundamental open questions ...

# Open questions

- What does bypassability imply?
  - Is this an impossibility result? What percentage of proposers will bypass?
- What does enshrining aim to achieve?
  - "Relay of last resort?" A means to other protocol upgrades?
- Is there any social layer incentive to use the protocol as designed?
  - `ETH` holders dictate what large node operators do. Is the value of `ETH`, the asset, correlated to the decentralization of the protocol?
- How important is L1 ePBS in a future with L2s and OFAs?
  - If the L1 MEV starts drying up, maybe ePBS is unnecessary? Do we think this will actually occur?
- Where should ePBS fall in the priority list of consensus upgrades?
  - Some other high-prio items – inclusion lists, single-slot finality, `MAX_EFFECTIVE_BALANCE`.

# Wrap-up

- We are extremely dependent on `mev-boost`
- Many out-of-protocol solutions to experiment with
- In-protocol designs are also still evolving
- Relays will probably still exist even in a "post-ePBS world"
- There are many open questions following from that ↑↑↑

ty for listening! :-)

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