Updates on Proposer-Builder Separation (PBS)

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In the previous episode...
The blockspace good

We’re all learning what blockspace is, what its properties are, how to sell it, how to provide for it. We know it’s valuable, but some of it is more valuable than the rest...
While the Resistance #stakefromhome, solo validators are rookies in a market of galactic proportions.

To keep up with the Empire, rebels source blocks from distant planets. But the trade is fraught with difficulties...
Prehistory of PBS: mev-geth in Proof-of-Work

Searchers submit bundles to (trusted) block producers.

Bundles are scored, merged, included by the block producer.
Block-building today (in Proof-of-Stake)
## The present of PBS: mev-boost for PoS Ethereum

<table>
<thead>
<tr>
<th>Bidding phase</th>
<th>Bid selection</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Builders</strong> send full block + bid to <strong>Relay</strong></td>
<td><strong>Proposer</strong> receives bids from <strong>Relays</strong></td>
<td><strong>Relay</strong> receives signed bid</td>
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<tr>
<td><strong>Relay</strong> validates bids</td>
<td><strong>Default</strong>: mev-boost selects highest bid</td>
<td><strong>Relay</strong> releases full block to <strong>Network</strong></td>
</tr>
<tr>
<td>(block validity + bid amount)</td>
<td><strong>Proposer</strong> signs bid, can no longer make another block</td>
<td></td>
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Today's numbers

More and more validators choose to use external block building

Flashbots relay still dominant

7 identified relays
Section 2

What is PBS?

Let’s make sense of it together!
“Proposer-Builder Separation” separation

A market structure

There are duties that the proposer can’t or won’t do:

- Making an exec-block
- Danksharding block
- Computing block witness
- Computing validity proofs

Proposer-Builder Separation:
The proposer outsources block construction to third-parties

An allocation mechanism

Whole block auction: The proposer sells off their *entire* rights to make a block.

Current design allocates the right to make an exec-block to a third-party:

- Builders submit bids
- Proposer selects their favourite
- Contract is entered into by both parties
**Market structure**

Relays are “brokers”

- Relay expected to guarantee validity of the good
- Relay could fail
  - Submit an invalid block
  - Pay proposer less than promised
  - Deliver late/not at all

**Allocation mechanism**

**Whole block auction:** The proposer sells off their *entire* rights to make a block.

Highest bid selected by mev-boost.
Market structure

Protocol is the "broker"

- Builder bids are binding, whether they deliver a valid good or not
- **Valid good**: Valid block made by selected builder

Allocation mechanism

**Whole block auction**: The proposer sells off their *entire* rights to make a block.

Proposer selects bid they would like to use.
The future of PBS? “Two-slot” in-protocol PBS

**Bidding phase**
- Builders send bids to Proposer
- Proposer selects bid, makes a beacon block committing to the bid
  - Attesters give weight to the beacon block

**Bid selection (Slot 1)**
- Proposer selects bid, makes a beacon block committing to the bid
- Attesters give weight to the beacon block

**Delivery (Slot 2)**
- Builder releases builder block containing payload
- Attesters give weight to the builder block

5 ETH
7 ETH
8 ETH

Builder Block

Proposer

8 ETH
Market structure

Protocol is the “broker”

- Builder bids are binding, whether they deliver a valid good or not
- **Valid good**: Valid block made by selected builder

Allocation mechanism

**Inclusion-listed whole block auction:**
The proposer sells off the right to make a block respecting some inclusion list.

Proposer selects bid they would like to use.
Market structure

Protocol is the “broker”

- Builder bids are binding, whether they deliver a valid good or not
- **Valid good:** Valid block made by selected builder

Allocation mechanism

**Partial block auction:** The proposer sells off the right to make a **partial** block.

**Proposer could be making block prefix, or suffix.**

Proposer selects bid they would like to use.
Market structure

Protocol is the “broker”

- Builder bids are binding, whether they deliver a valid good or not
- **Valid good**: Valid block made by selected builder

Allocation mechanism

**Slot auction**: The proposer sells off the right to make a block, **but the bid doesn’t commit the builder to any specific block**.

Proposer selects bid they would like to use.

Selected builder can release any block they want.
In-protocol PBS variations

Several designs for the allocation mechanism

- **Whole or partial block auction** (which part?)
- **Inclusion lists** (made by whom?)
- **Slot auction** (auctioned when?)

Should the protocol make that decision?

Or simply **guarantee the market structure**?

See my recent **Protocol-enforced proposer commitments (PEPC)** proposal!
Section 3

Looking ahead
What if we had in-protocol PBS?

- **Would proposers use it?**
  IP-PBS bid may not be an **objective oracle** of block value to proposer
  Possible to enter into **off-chain agreements** (builder colocation)
  **MEV-smoothing** would make it binding, but more questions there...

- **Would relays still exist?**
  How to design the “**protocol-side**” **gossip channel** for bids?
  Proposers could still decide to connect to **relays for freshest bids**
  or **constrained bids** (e.g., censorship)
  Some builders might even want to use mev-boost (no upfront capital)
Seeing like a protocol

- What does PBS value exactly?
  **Total extractable value** by the proposer.
  Or is it? Can a builder realise this value? Can a distributed builder?
  Or is PBS bid = “**spot price** of value for the block”?
  Is there EV from selling rights before the proposer’s slot?
  Selling rights to multiple builders?

Is this value?
What is Ethereum?

Where do Ethereum’s concerns stop?

- **At the client level?** Provide more ways for out-of-protocol markets to organise? e.g., proposer specifies inclusion list, block prefix... to mev-boost
- **At the market structure?** E.g., making sure proposer is paid when things go south? PEPC is a proposal in that direction
- **At the allocation mechanism?** Determine some/all markets/mechanisms, fully specify contracting space between proposers and third-parties

Some (incomplete) ways to think about it:

**Risk for the protocol?** Safety, liveness, throughput? Does it maximise welfare? Outsourcing may be good! Sometimes, more incentive-alignment.

**Risk for the proposer?** Should the protocol protect them?
More PBS at devcon

- **Block building after the Merge**
  - Day 2 — Oct 12, 2022
  - Speaker: Alex Stokes

- **Hybrid PBS from CL's Perspective**
  - Day 3 — Oct 13, 2022
  - Speaker: Terence Tsao

- **Evaluating the PBS Experiment: Early insights from MEV-Boost and the Builder Market**
  - Day 3 — Oct 13, 2022
  - Speaker: Jolene Dunne

- **MEV for the Next Billion: It’s Time to Get Serious...**
  - Day 4 — Oct 14, 2022
  - Speaker: Philip Daian
Thank you!

Strong research background? Mechanism design expert? Want to help us make sense of it?

Apply to the RIG now!

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