

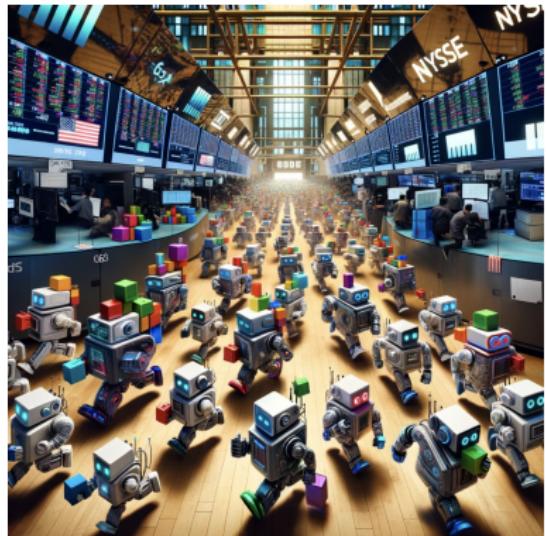
Execution Tickets



mike neuder
beyond the block, titan & hashkey
friday, march 1, 2024

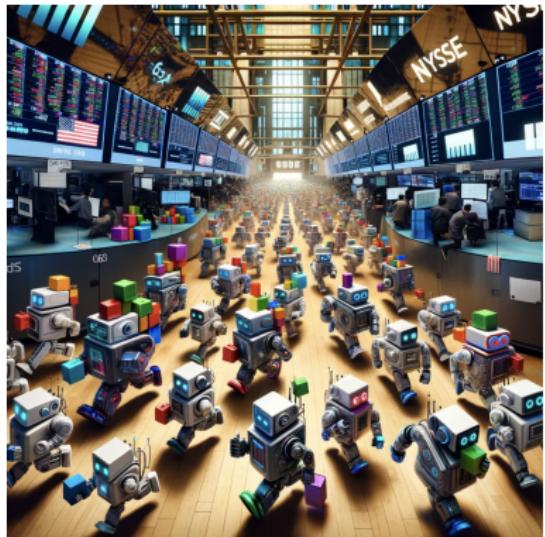
Outline

- Problems
 - ◊ Proposer-Builder Separation
 - ◊ Consequences
 - ▶ Warping validator economics
 - ▶ Timing games
 - ▶ Censorship
 - ▶ Fragility



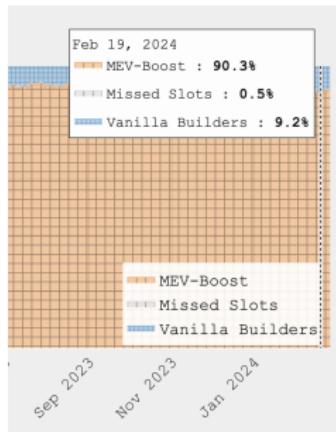
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- Solutions
 - ◊ ePBS ≠ enshrined-mev-boost
 - ◊ Execution Tickets
 - ▶ Slot construction
 - ▶ Block production
 - ▶ Secondary markets
 - ▶ Brief ™ analysis



Proposer-Builder Separation

"almost all proposers sell their full blocks to three builders"



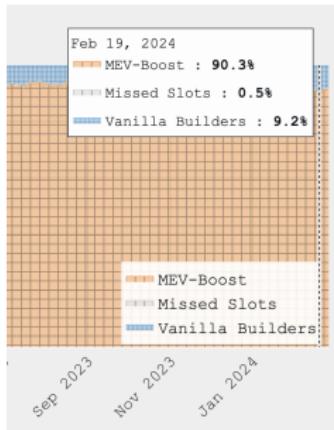
<https://mevboost.pics/>

<https://www.relayscan.io/>

<https://vitalik.eth.limo/general/2021/12/06/endgame.html>

Proposer-Builder Separation

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Builder (extra_data)	Blocks	Percent
beaverbuild.org	2,844	42.59 %
Titan (titanbuilder.xyz)	1,787	26.76 %
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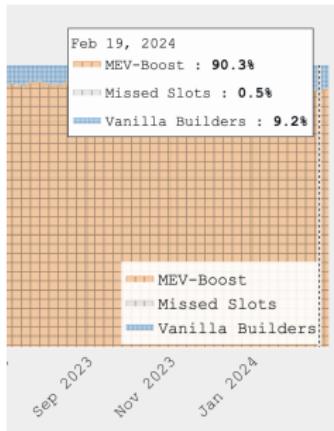
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- Vitalik's endgame – December 2021: “So what's the result? Block production is centralized, block validation is trustless and highly decentralized, and censorship is still prevented.”

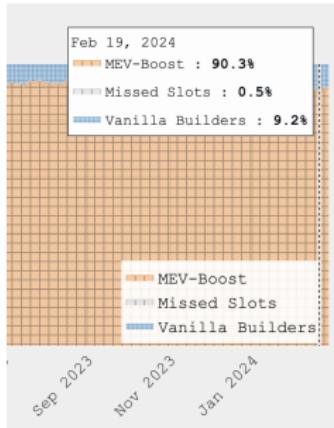
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- Vitalik's endgame – December 2021: “So what's the result? Block production is centralized, block validation is trustless and highly decentralized, and censorship is still prevented.”
- Not that far off! But we have a few issues...

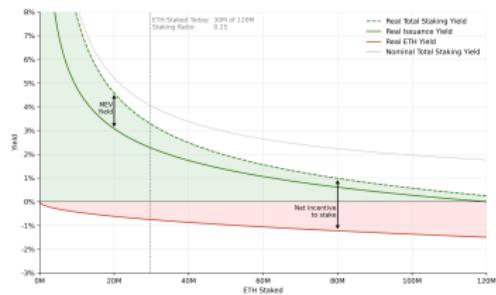
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Consequences

(i) Warping validator economics

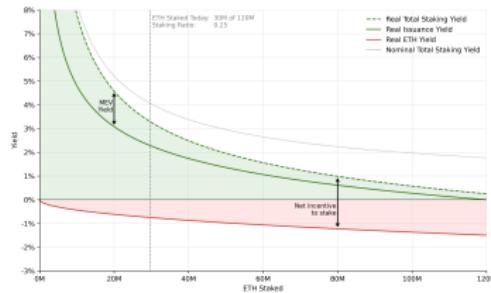


<https://ethresear.ch/t/endgame-staking-economics-a-case-for-targeting/18751>

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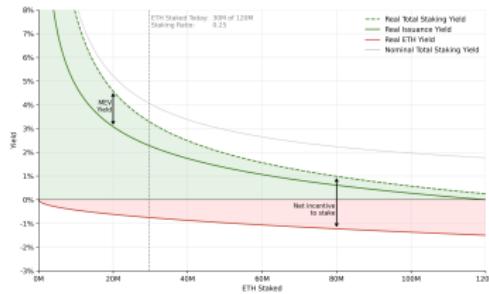


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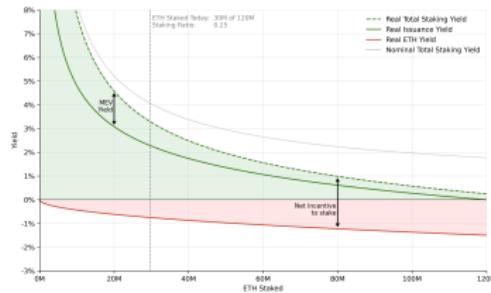
- MEV rewards make it more attractive to be a validator.

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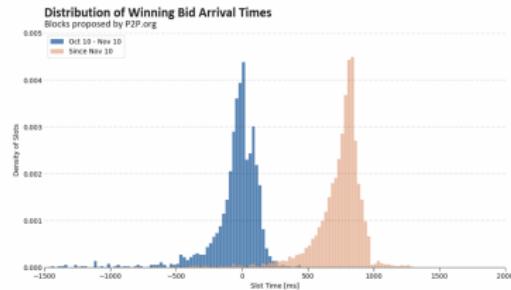
- MEV rewards make it more attractive to be a validator.
- Centralizing force: high-variance rewards make pooling attractive.

<https://ethresear.ch/t/endgame-staking-economics-a-case-for-targeting/18751>

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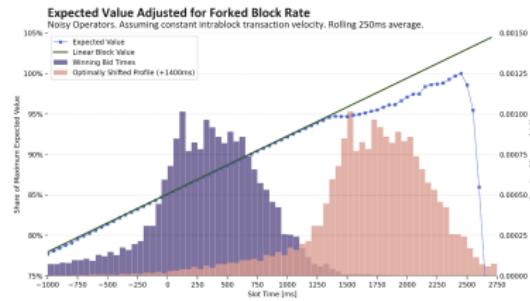
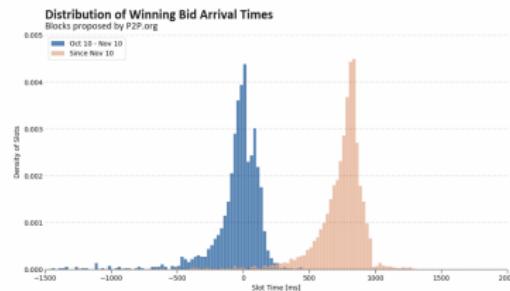
Consequences

(ii) Timing games



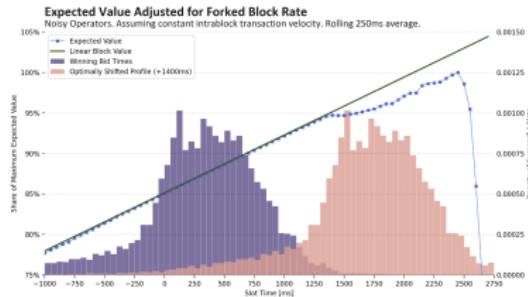
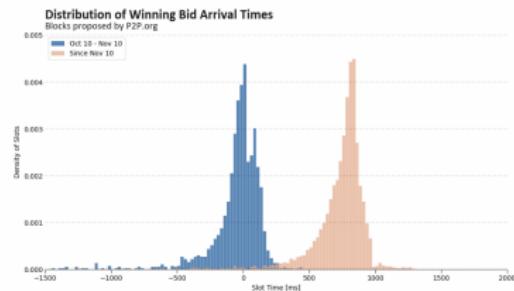
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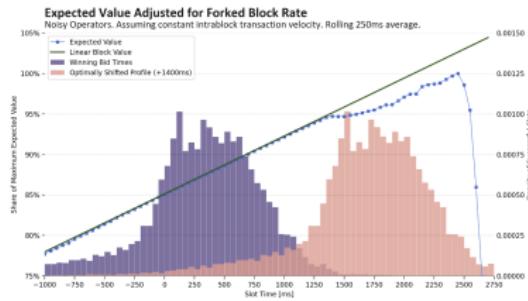
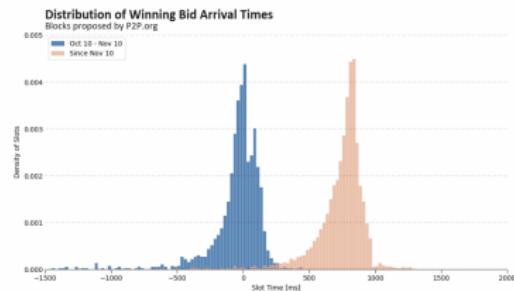
(ii) Timing games



- Delaying block production increases MEV rewards.

Consequences

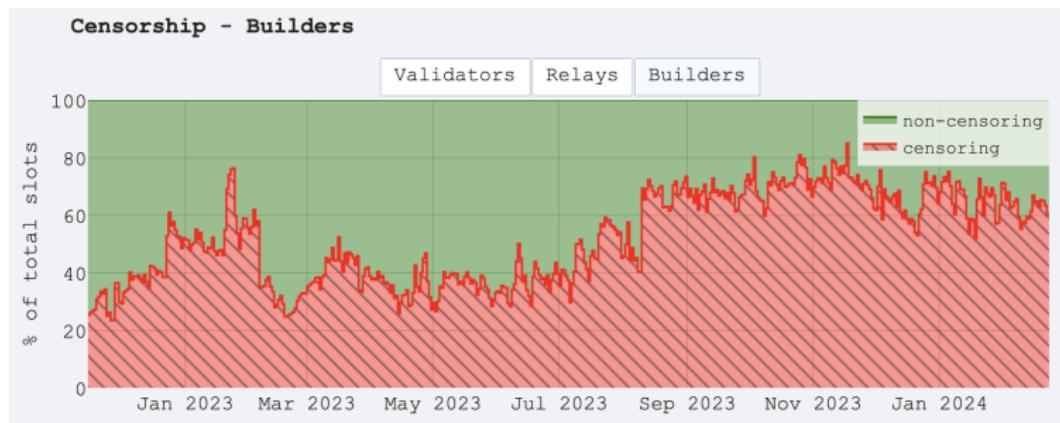
(ii) Timing games



- Delaying block production increases MEV rewards.
- Centralizing force: latency-optimized validation is more profitable.

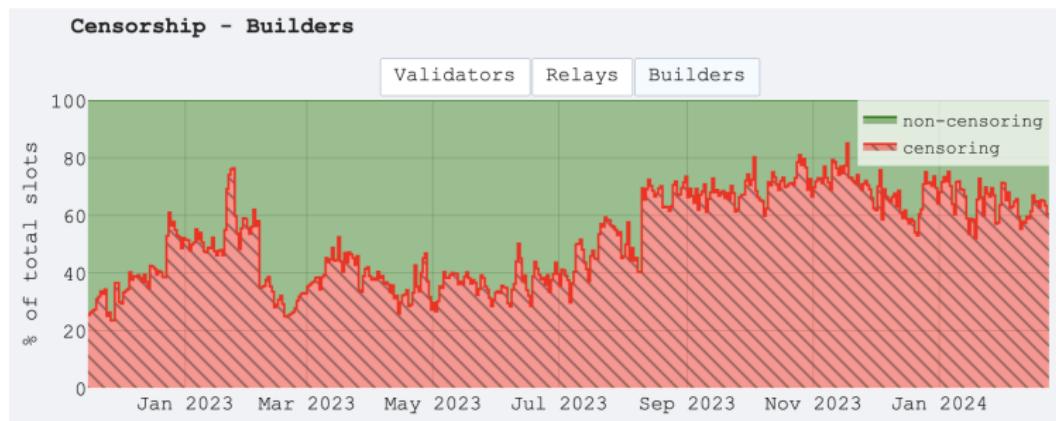
Consequences

(iii) Censorship



Consequences

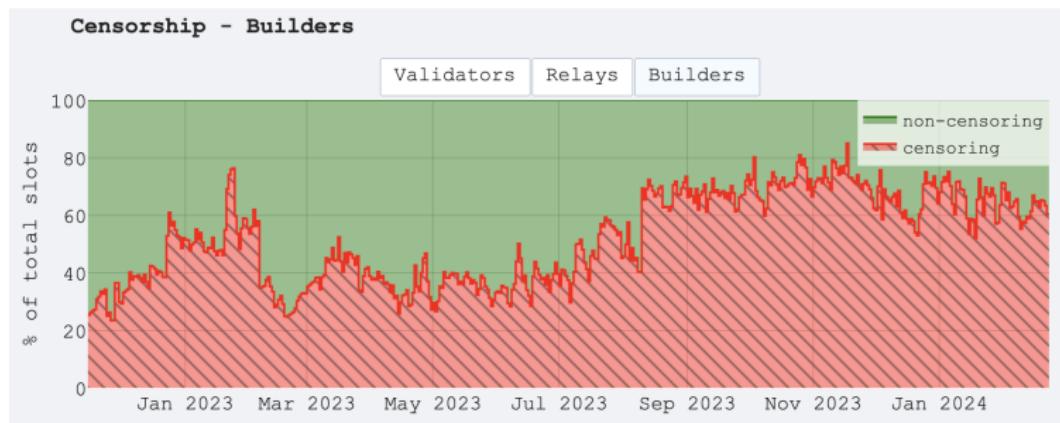
(iii) Censorship



- Builders dictate the set of included & excluded transactions.

Consequences

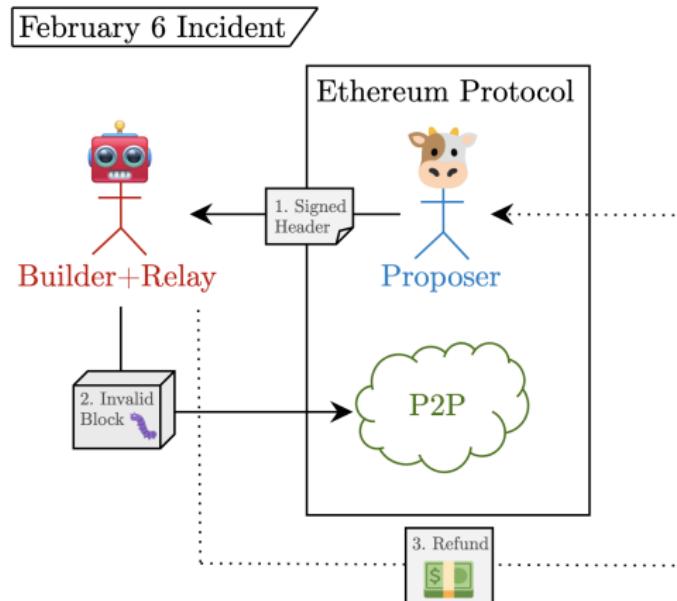
(iii) Censorship



- Builders dictate the set of included & excluded transactions.
- **Vitalik's endgame – December 2021:** “... and censorship is still prevented.”

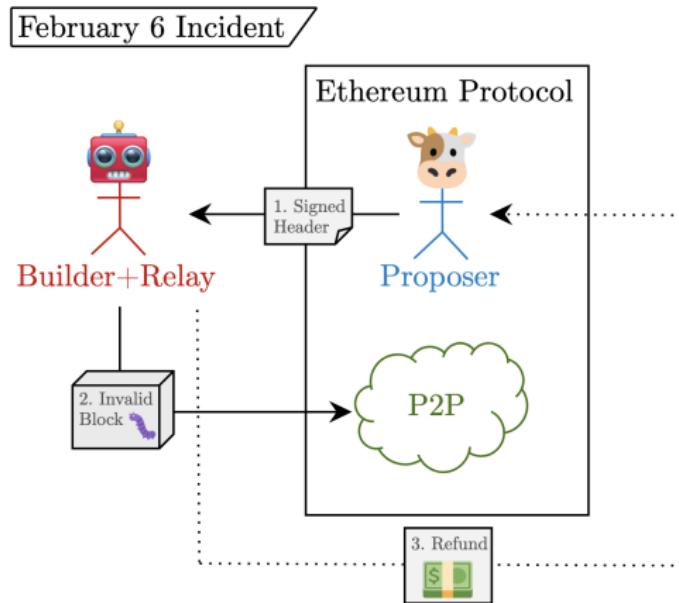
Consequences

(iv) Fragility



Consequences

(iv) Fragility



- Out-of-protocol software continues to be a thorn in everyone's side.

ePBS ≠ enshrined-mev-boost

there is no limit on imagination



ePBS ≠ enshrined-mev-boost

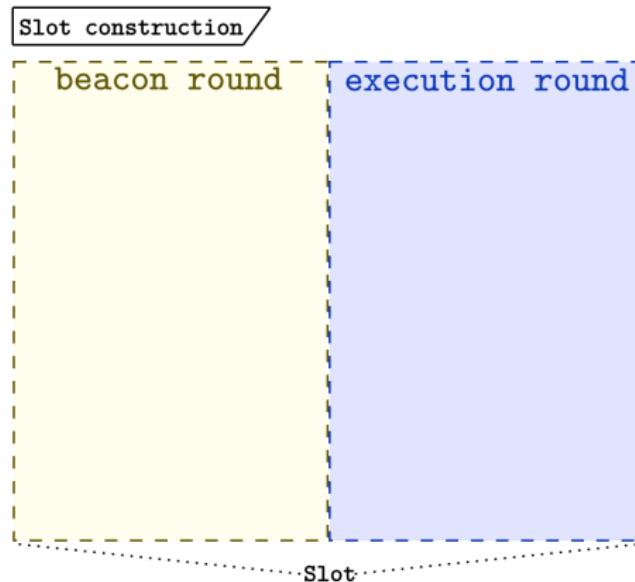
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- PEPC, Top-of-Block/Rest-of-Block, slot auctions, multiplicity gadgets, inclusion lists, etc. ...

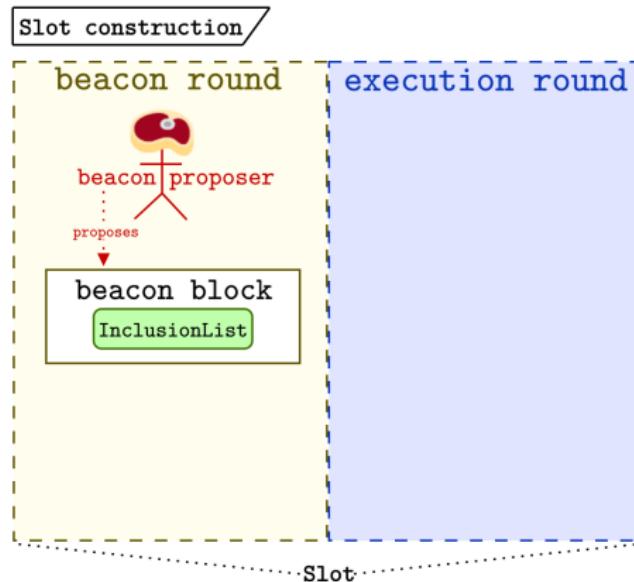
Execution Tickets

Slot construction



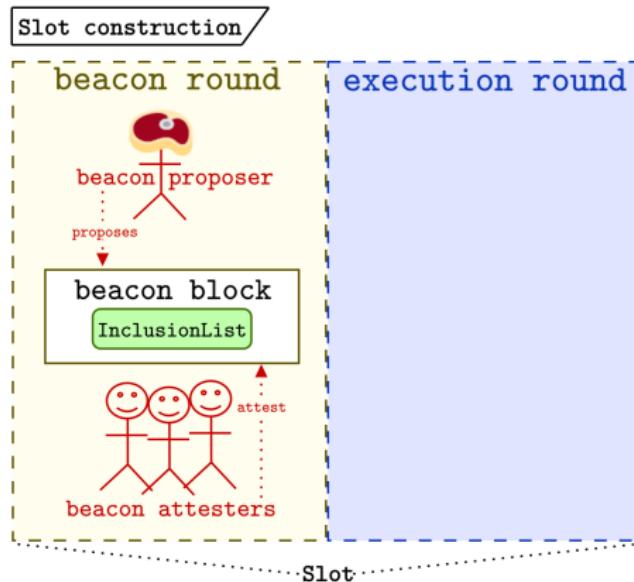
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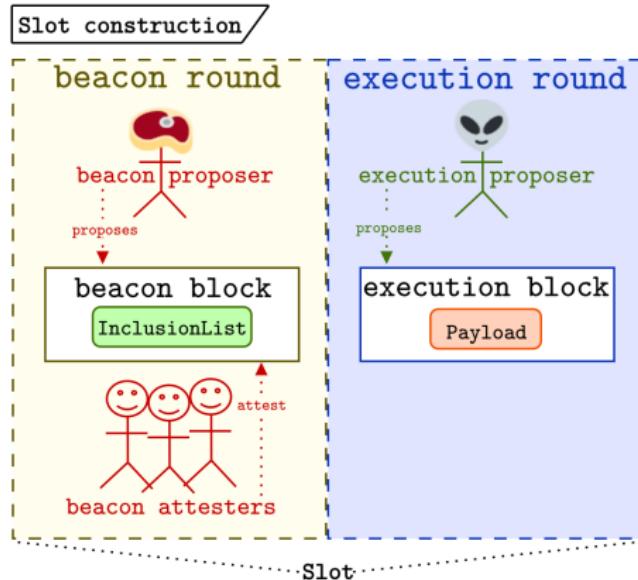
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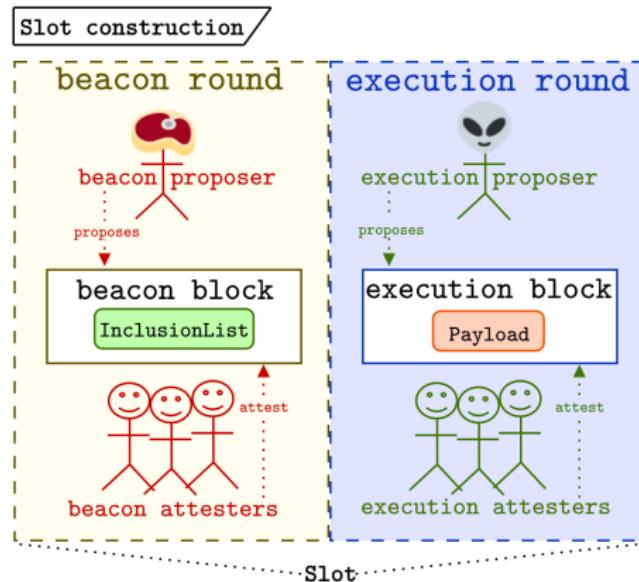
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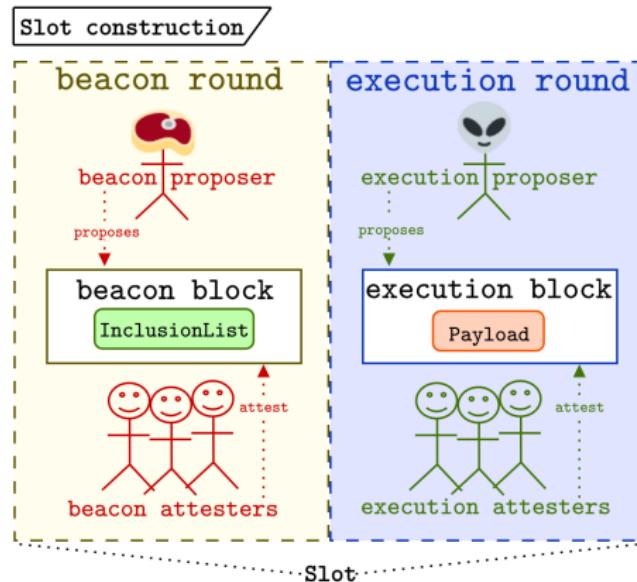
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Execution Tickets

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- Split slot into two rounds \implies two separate proposers and attesting committees.

Execution Tickets

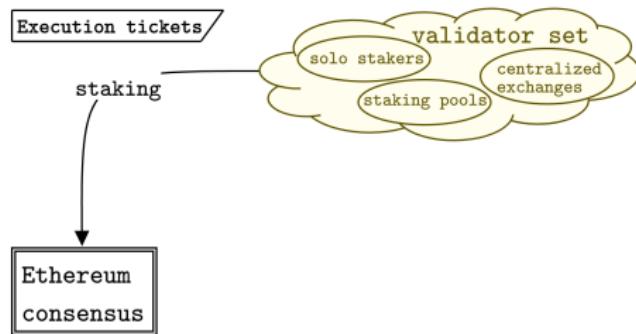
Block production

Execution tickets

Ethereum
consensus

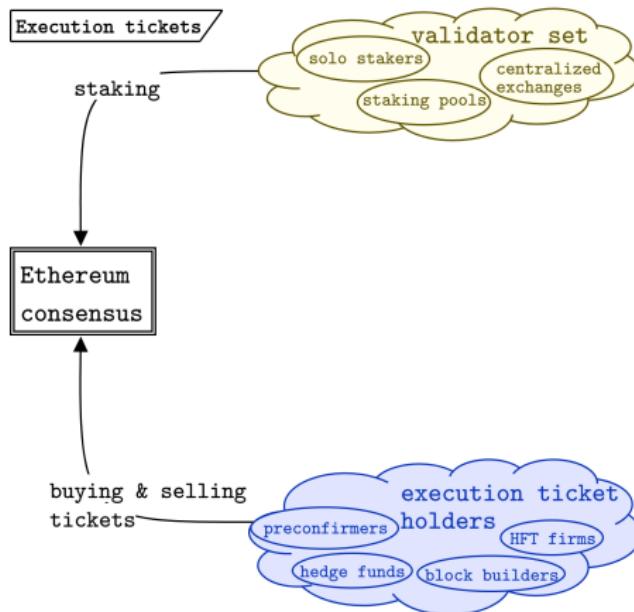
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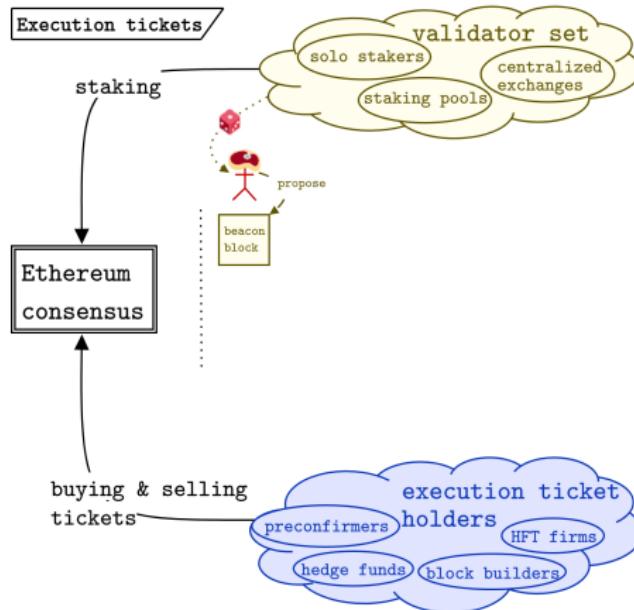
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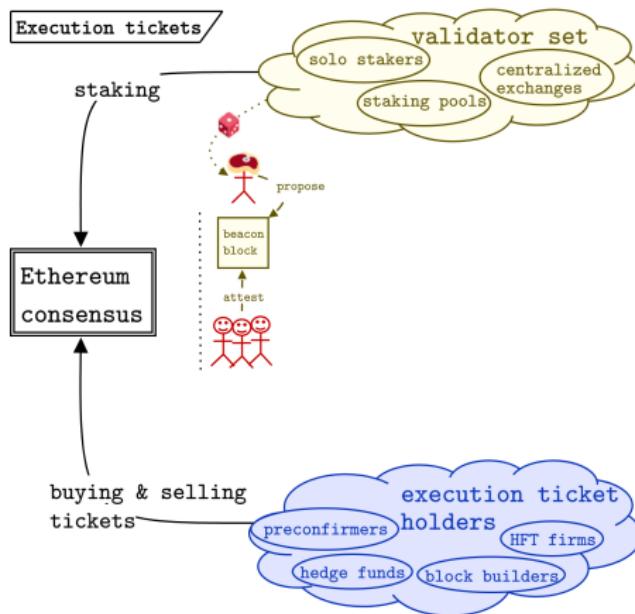
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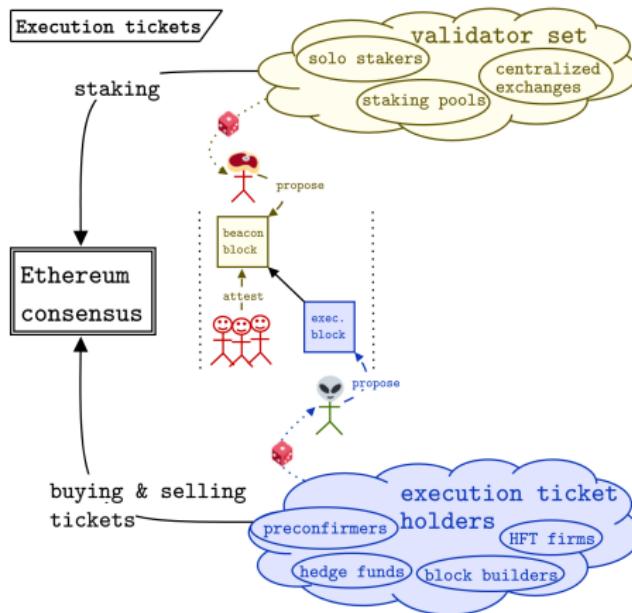
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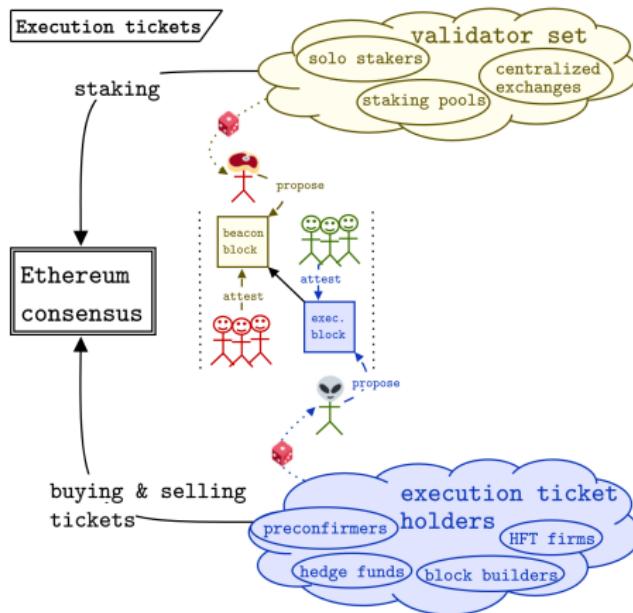
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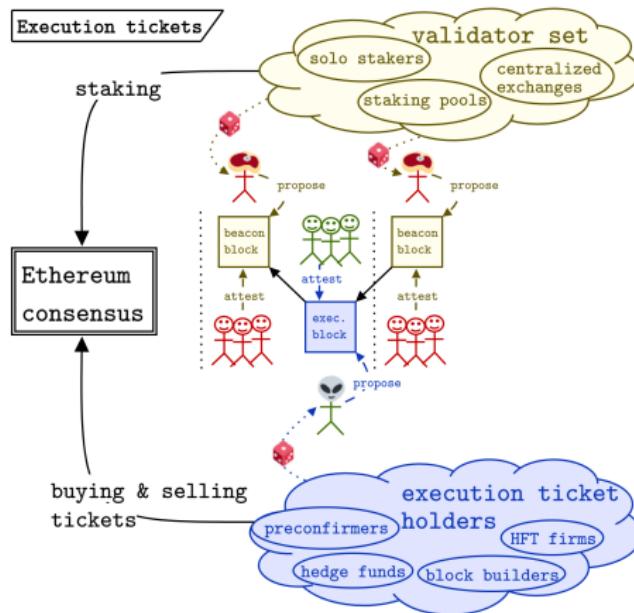
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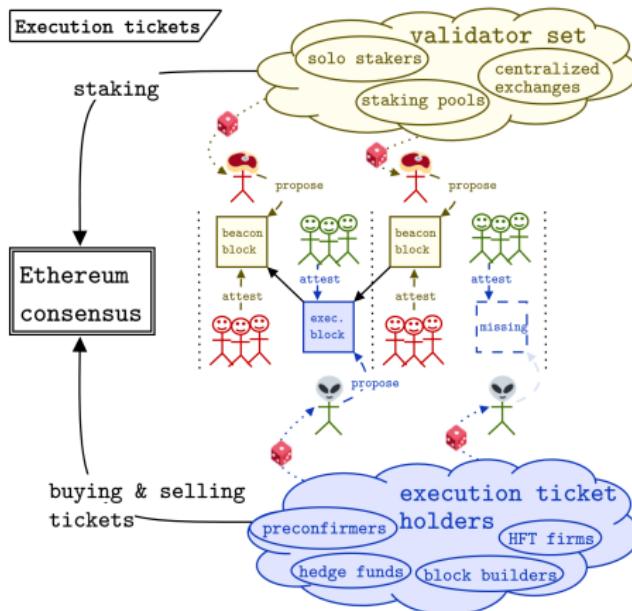
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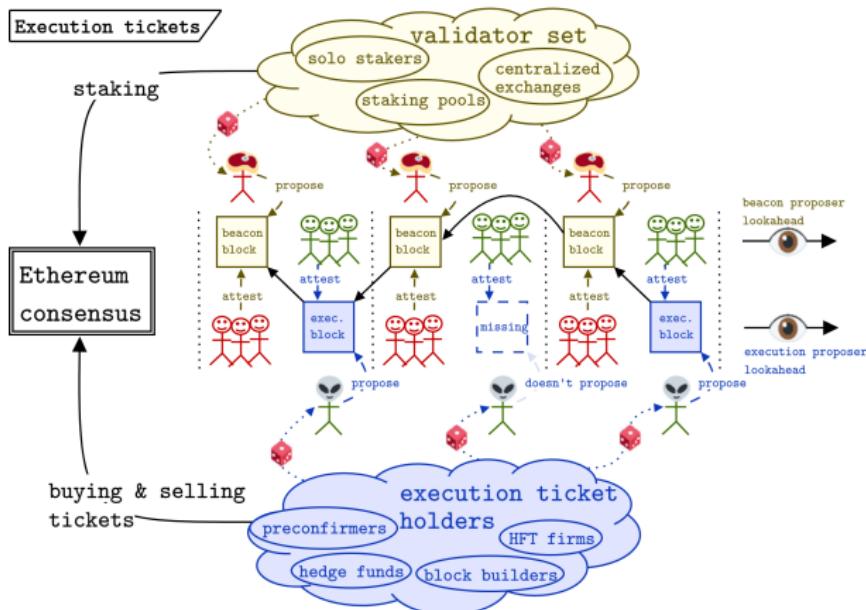
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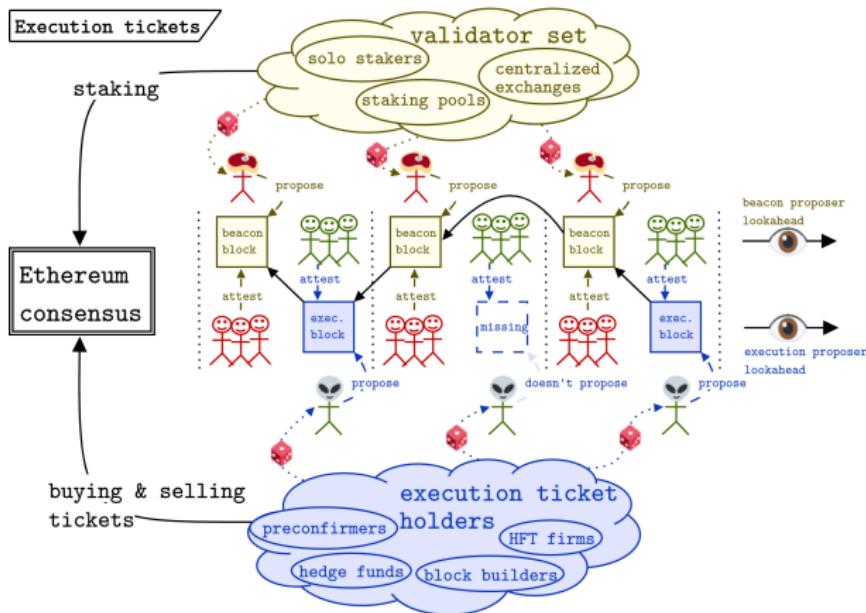
Execution Tickets

Block production



Execution Tickets

Block production



- Completely decouple consensus and execution.

Execution Tickets

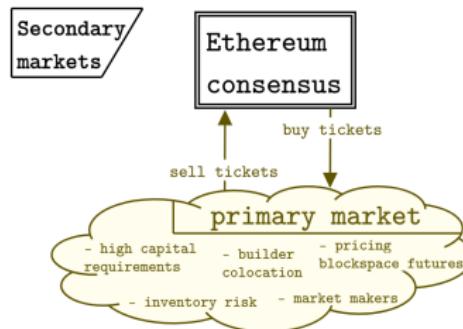
Secondary markets

Secondary
markets

Ethereum
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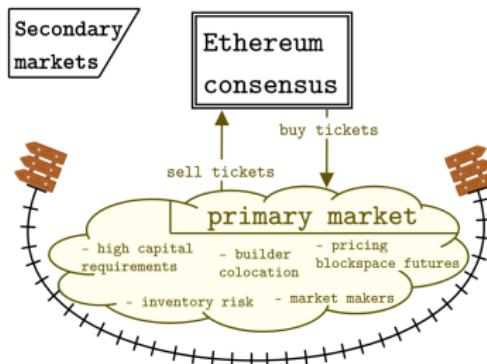
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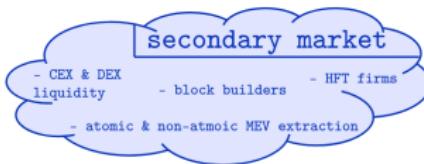
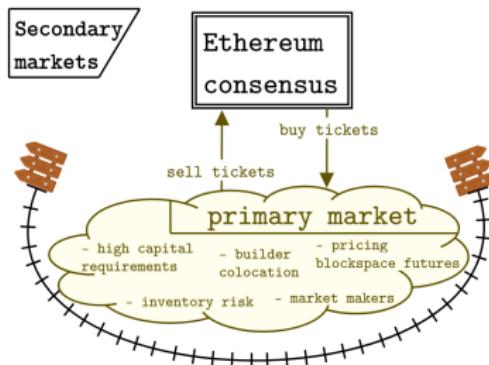
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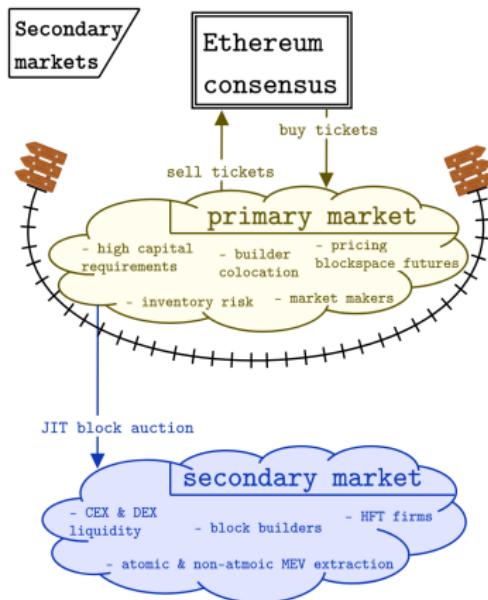
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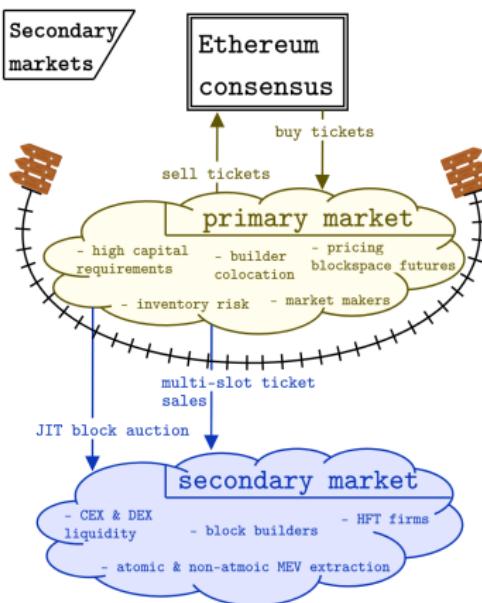
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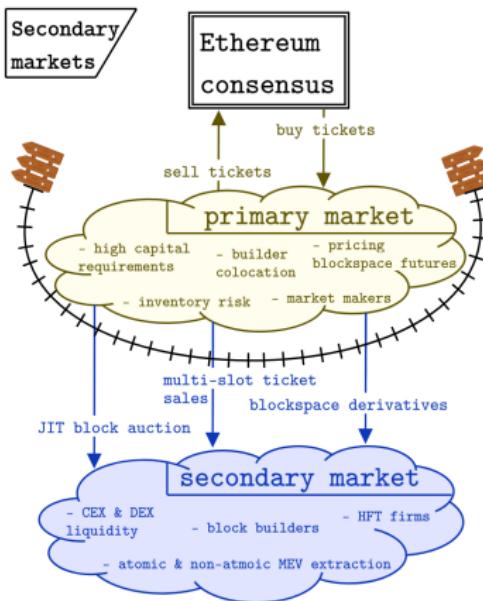
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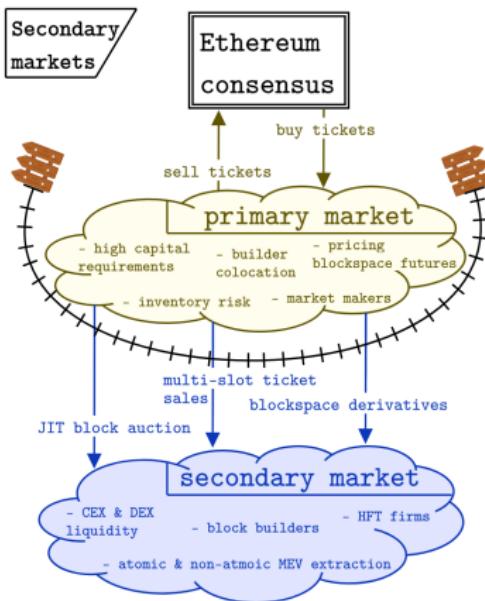
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- Market structure of secondary ticket sales evolves out of protocol.

Execution Tickets

Brief™ analysis

- Pros:

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- ◊ Centralization generally.
- ◊ Fork-choice implications.
- ◊ Are inclusion lists sufficient?
- ◊ Unknown unknowns...

thanks! :-)

