Fair rewards for more decentralised attesters

A DAG-based reward mechanism

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Why we need decentralised attesters

Validators as attesters come to consensus on the chain.
Thousands of votes are cast every round.

We **need** these votes to remain **truthful**.
We **need** to **secure** the attesters' voice.

Our current mechanisms are too brittle.
We present here an alternative.

Breaking the balance of power

Joint work with Roozbeh Saranche, Ertem Nusret Tas, Caspar Schwarz-Schilling, Bart Preneel

A simple commitment attack

Commitment attack

Deploying a smart contract “**warping**” the incentives of other validators to do the correct thing.

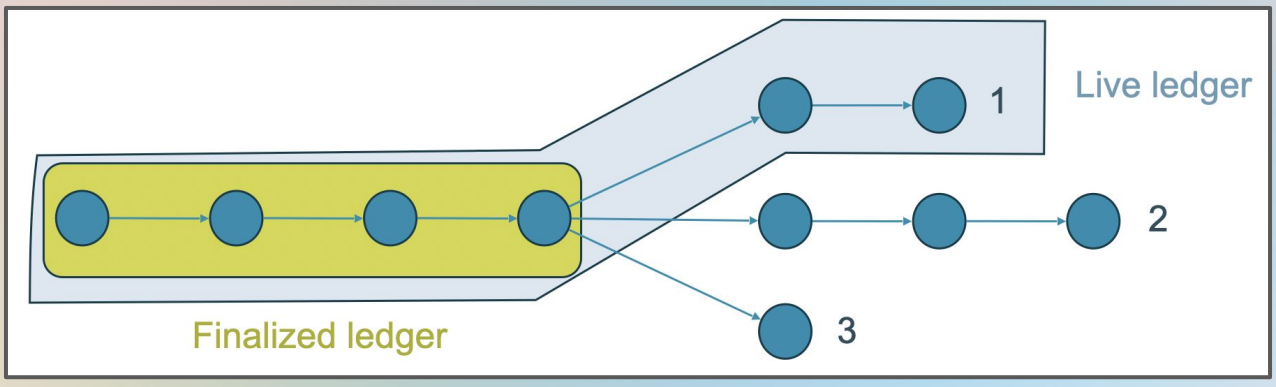
- Attacker commits to course of action.
- Victims must adjust behaviour/actions in reply.
- Coordinates victims towards attacker’s preferred outcome.

Interesting questions regarding the credibility of the commitment… but we don’t lack ways of being more credible :)

Gasper 101

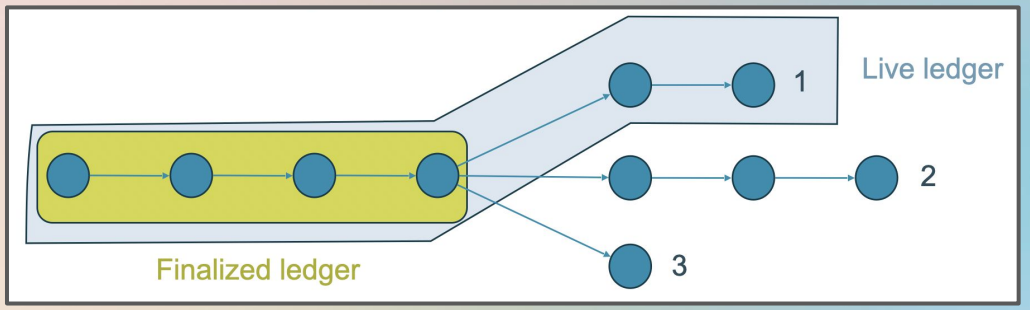
Ethereum's "Gasper" consensus mechanism has two components:

- FFG => **Finality** service
- LMD-GHOST => **Availability** service



Validator duties

To build the chain, a selected proposer makes a block.
The block contains user transactions and attester votes.
Attester votes have **FFG data** (what to finalise?)
and **LMD-GHOST data** (where is the head?).

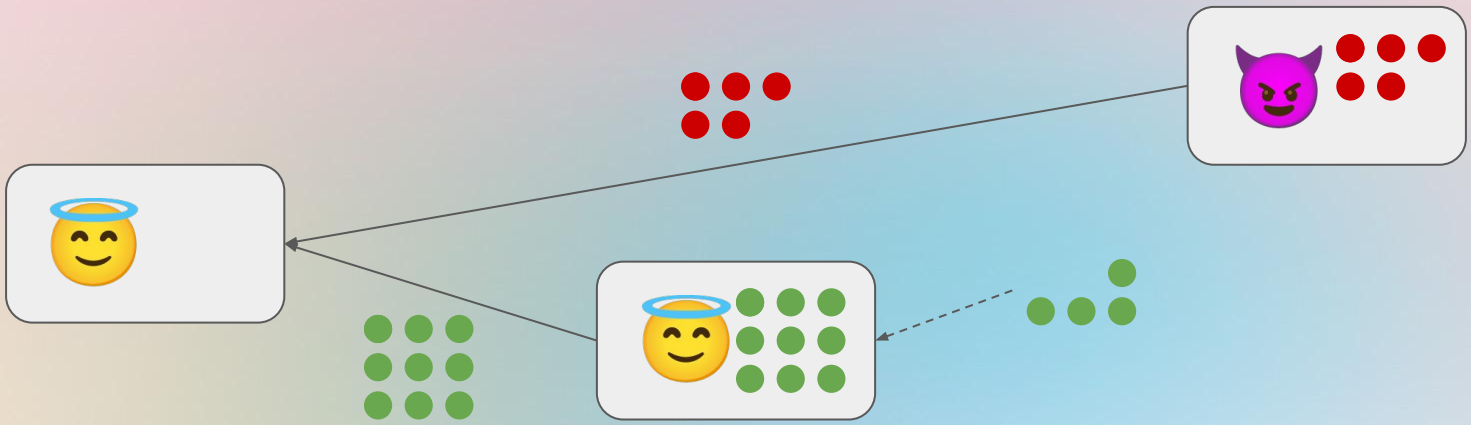


Good case

- Proposer 1 makes a block
- Attesters cast vote on the block
- Proposer 2 makes a block, includes attester vote

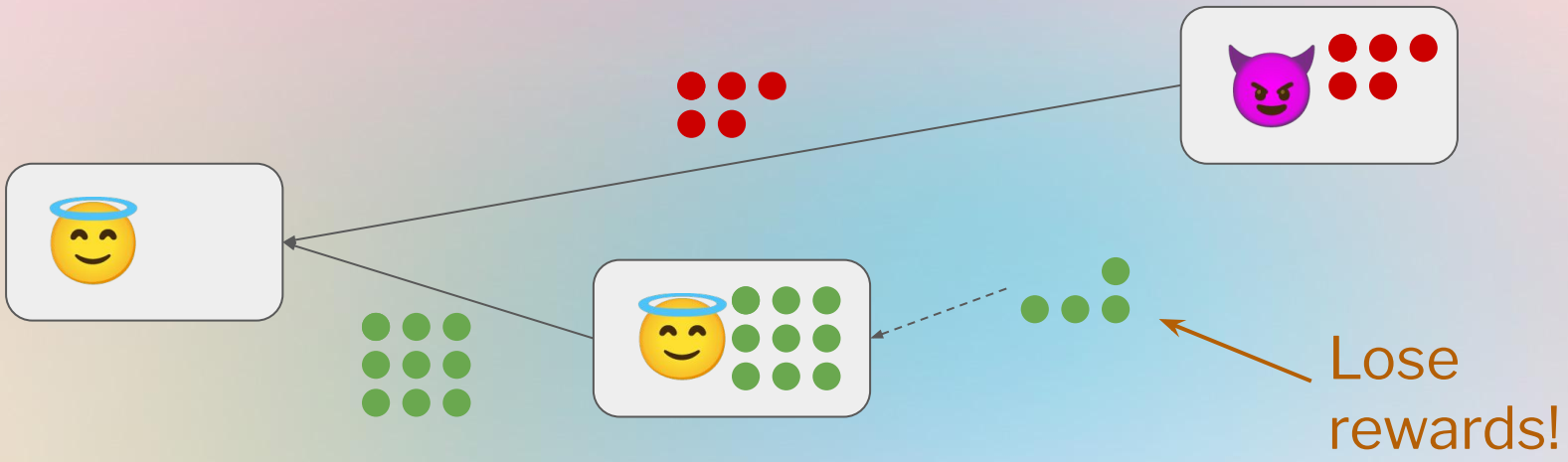
Proposer threat

The proposer threatens to ignore an attester vote if the attester doesn’t vote for the proposer’s chosen block.



Proposer threat

There is a Nash Equilibrium where attacker succeeds!



Extensions

In the paper we also discuss:

- Attacks over multiple blocks
  - With fixed attester sets (same players in all rounds)
  - With variable attester sets
- Attacks inspired by selfish mining attacks

Decentralising the proposer and fixing the rewards

Rewards in Ethereum Proof-of-Stake

Attesters are rewarded today when their head vote is:

- **Timely:** Included by the next proposer.
- **Correct:** Vote with the majority of attesters.

The timeliness constraint gives a lot of power to the next proposer!

Ensure timeliness without timely inclusion

The timeliness constraint gives a lot of power to the next proposer!

Strawman: Allow *any* proposer to include these votes.

… but how do we know that the votes were timely then?
We need the head votes ASAP!

Solution: Have attesters vote on the timeliness of other attesters!

~ Decentralise the role of the next proposer.

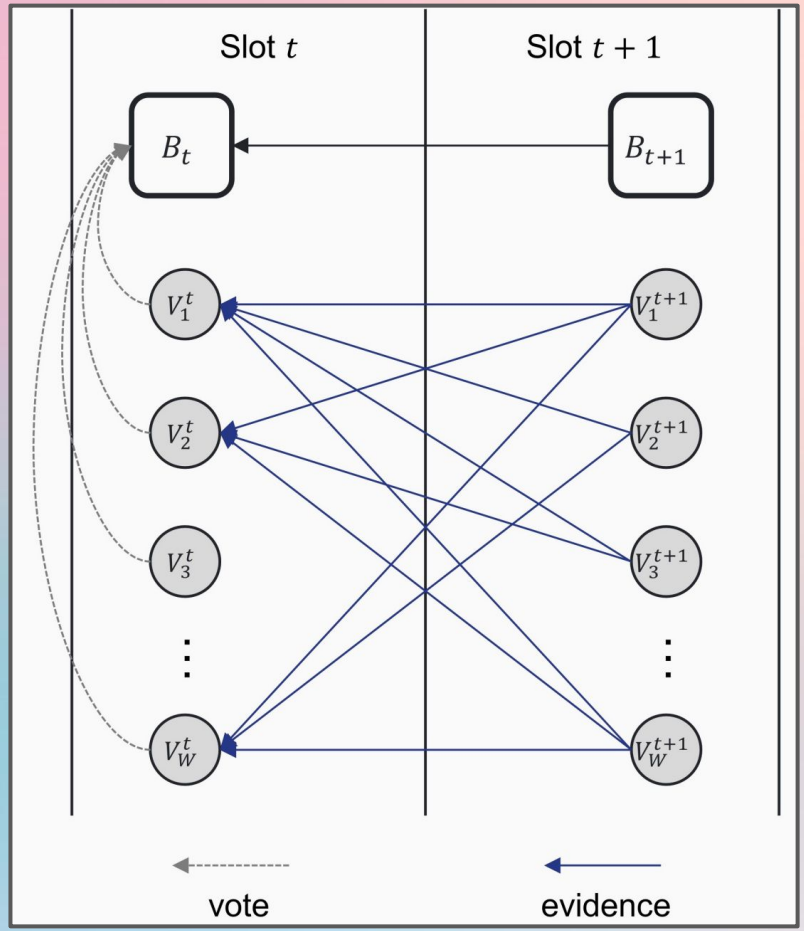
DAG-based votes

Attesters of slot *t*+1 vote on the votes of slot *t* attesters.

> “I have seen these votes arrive on time.”

These votes can be included **anytime**.

> Today, if block is missed, attesters lose reward :(



Performance

The DAG votes are a new object, creates overhead. But:

- In the good case (proposer is honest), then it’s not required, all votes are simply included.
- If proposer is missing or doesn’t include everything, then the DAG must be created.
- Worst-case is still reasonable.

~ think of it as insurance!

More on this in the paper.

Thank you!

https://rig.ethereum.org

see also “Breaking the Balance of Power: Commitment Attacks on Ethereum's Reward Mechanism”