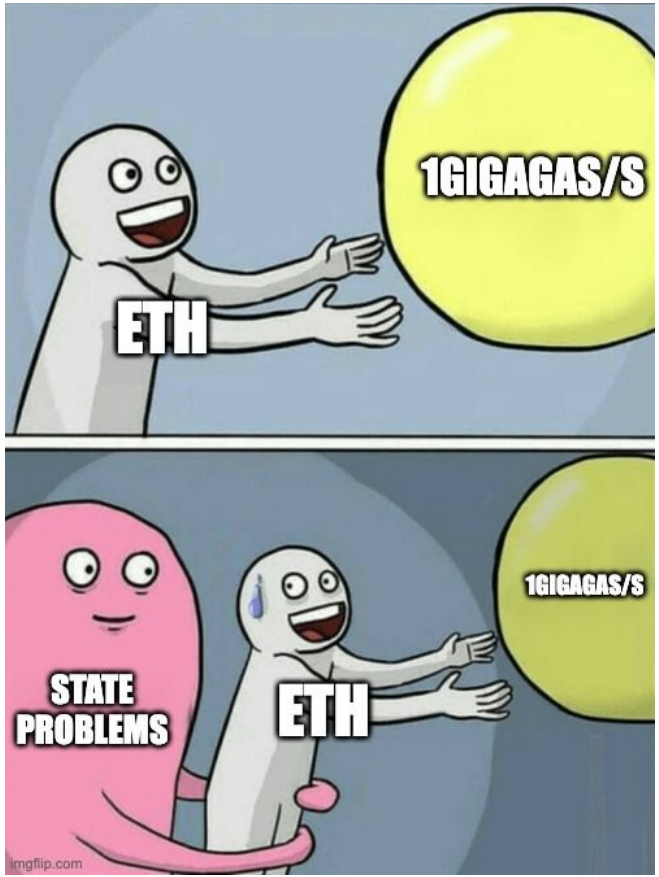
The Future of Ethereum's State

Wei Han Ng (@ngweihan_eth)
Stateless Consensus @ EF

ethereum foundation
Stateless Consensus


1GIGAGAS/S
ETH
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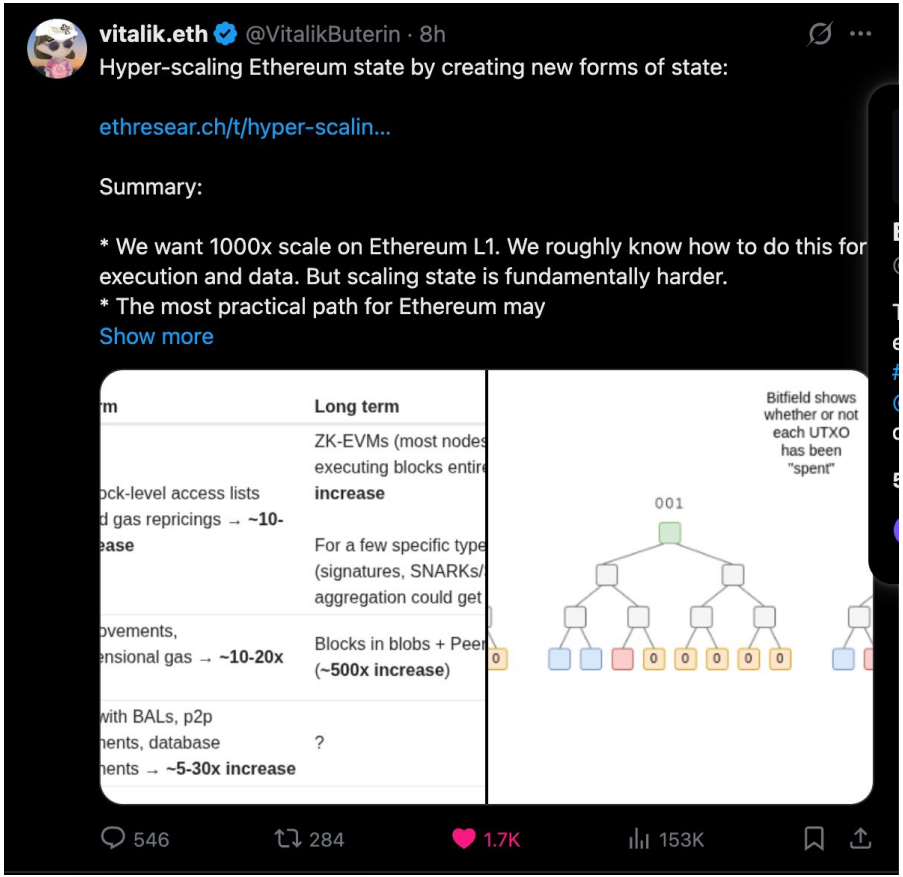
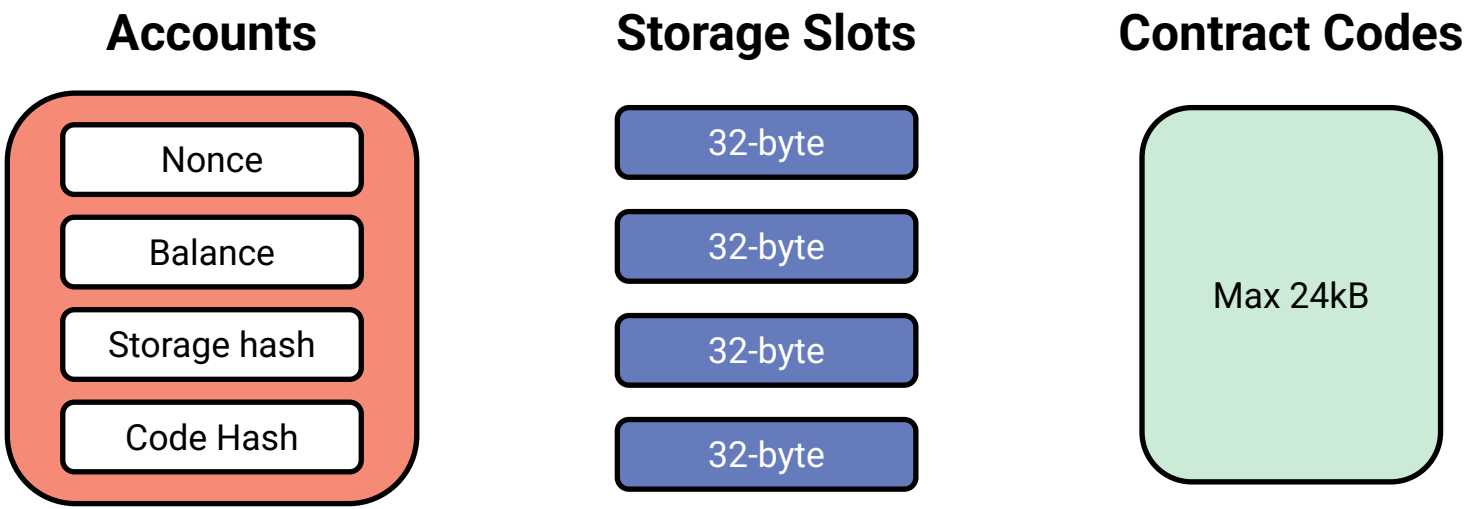
STATE PROBLEMS
ETH
imgflip.com

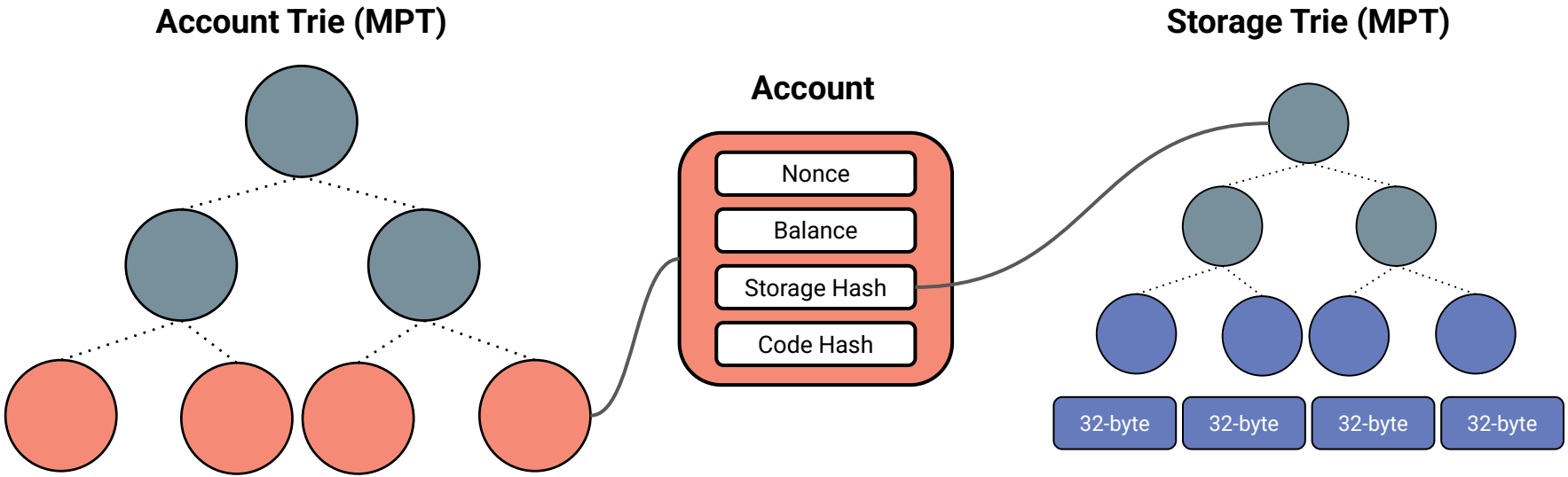

vitalik.eth @VitalikButerin · 8h
Hyper-scaling Ethereum state by creating new forms of state:
ethresear.ch/t/hyper-scalin...
Summary:
* We want 1000x scale on Ethereum L1. We roughly know how to do this for execution and data. But scaling state is fundamentally harder.
* The most practical path for Ethereum may
Show more
Long term
ZK-EVMs (most nodes executing blocks entire
increase
For a few specific type (signatures, SNARKs/ aggregation could get
Blocks in blobs + Peer (~500x increase)
?
Bitfield shows whether or not each UTXO has been "spent"
001
546
284
1.7K
153K


PRESENT

Ethereum's state

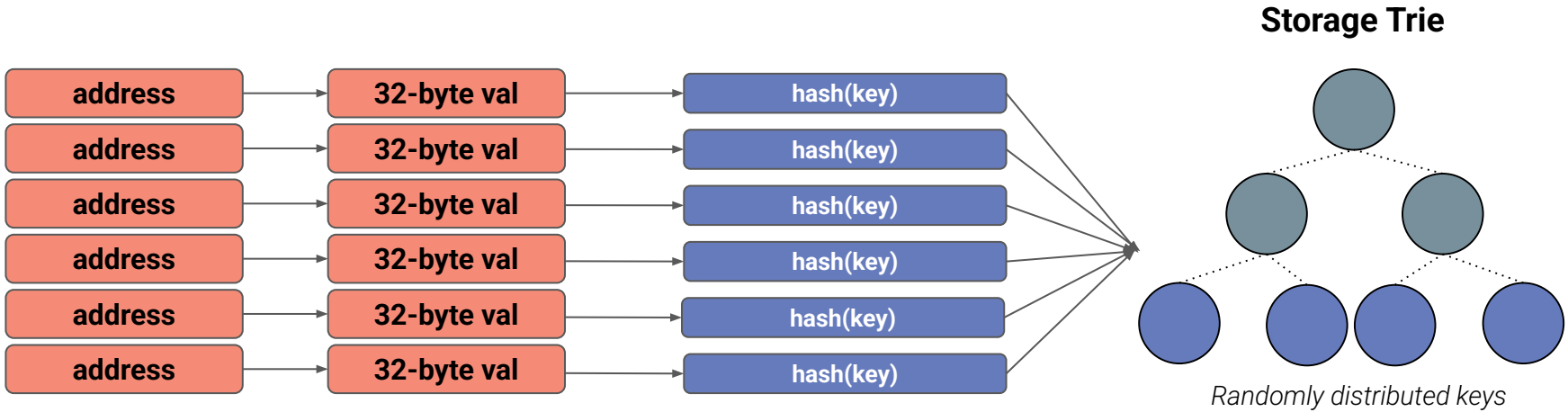


Ethereum's state



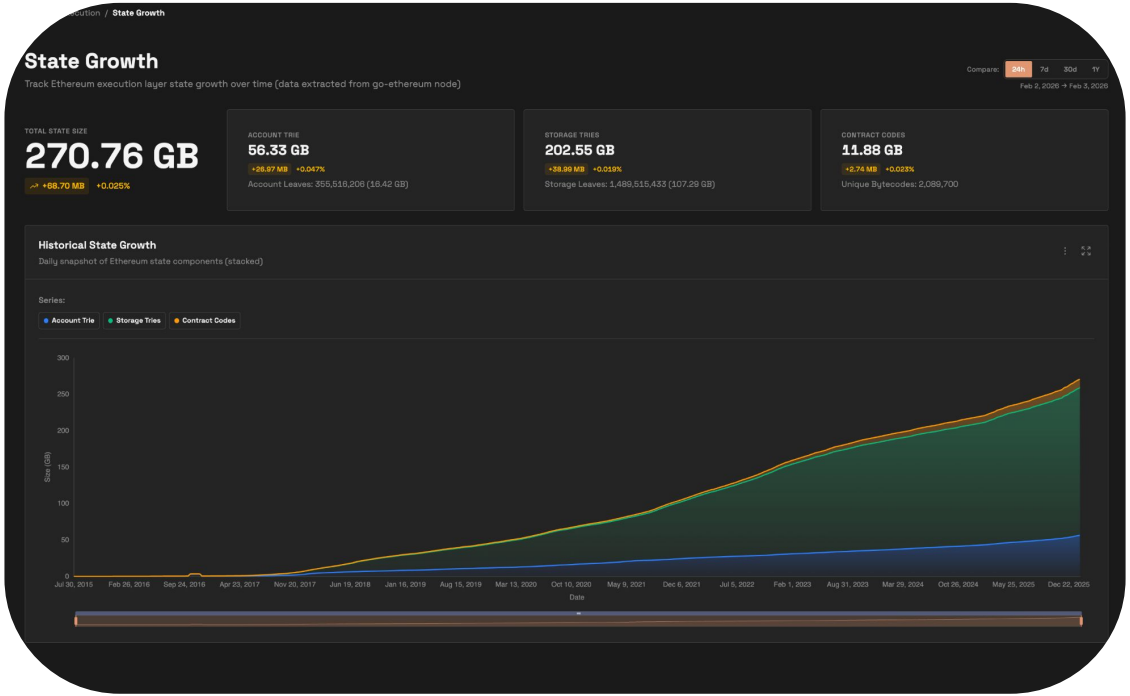
State is inefficient for real-world pattern

Majority of the state is **mapping(address => value)**



Problem: locality is terrible as keys are scattered in the trie

Ethereum's state size



lab.ethpandaops.io/ethereum/execution/state-growth

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Not all state is created equal

84% of accounts are active for **at most 1 year.**

55% of contracts are deployed once and **never touched again.**

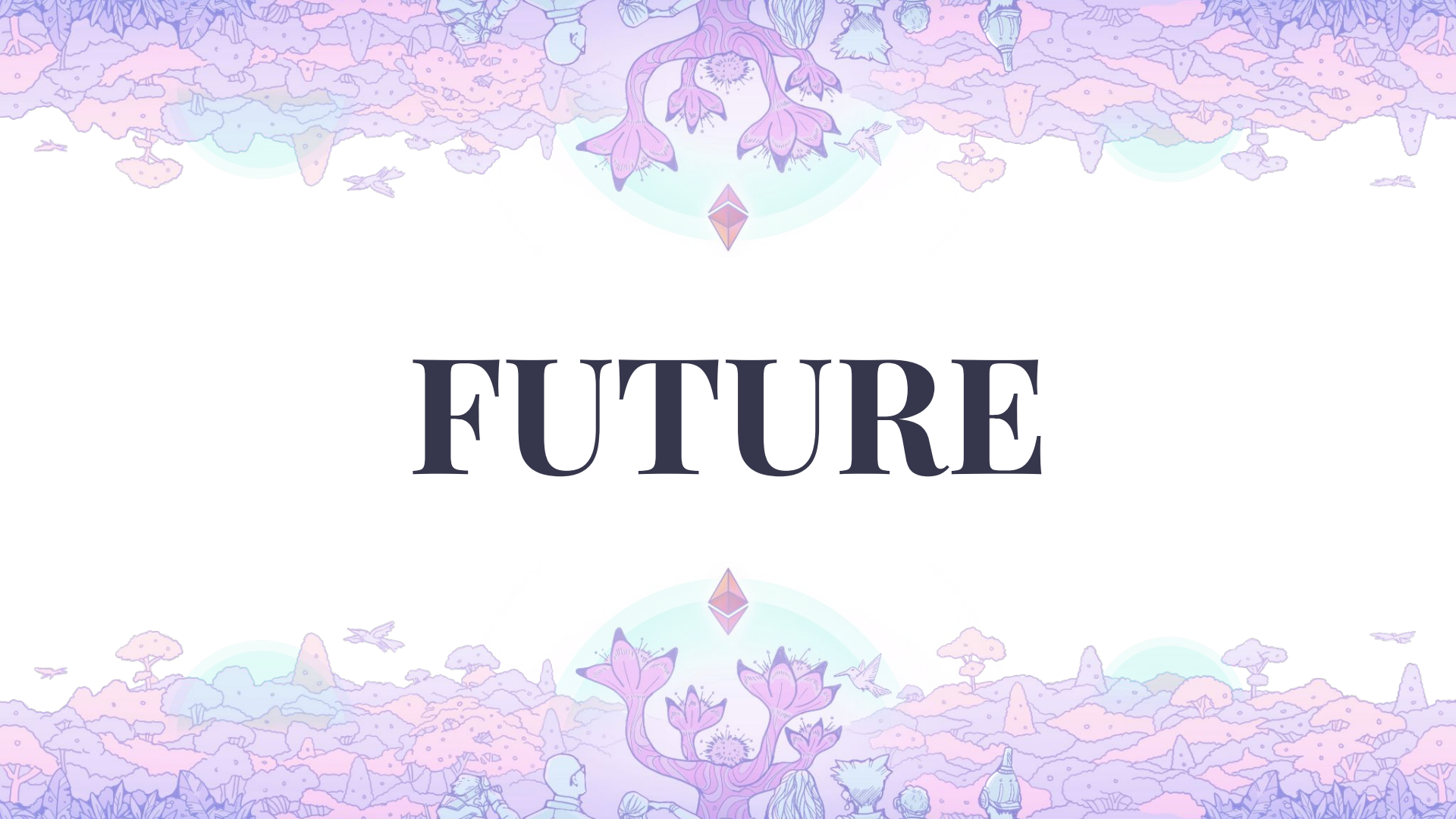
63% of storage slots are written once and **never touched again.**

97% of contracts reuse the same **9% of unique bytecodes.**

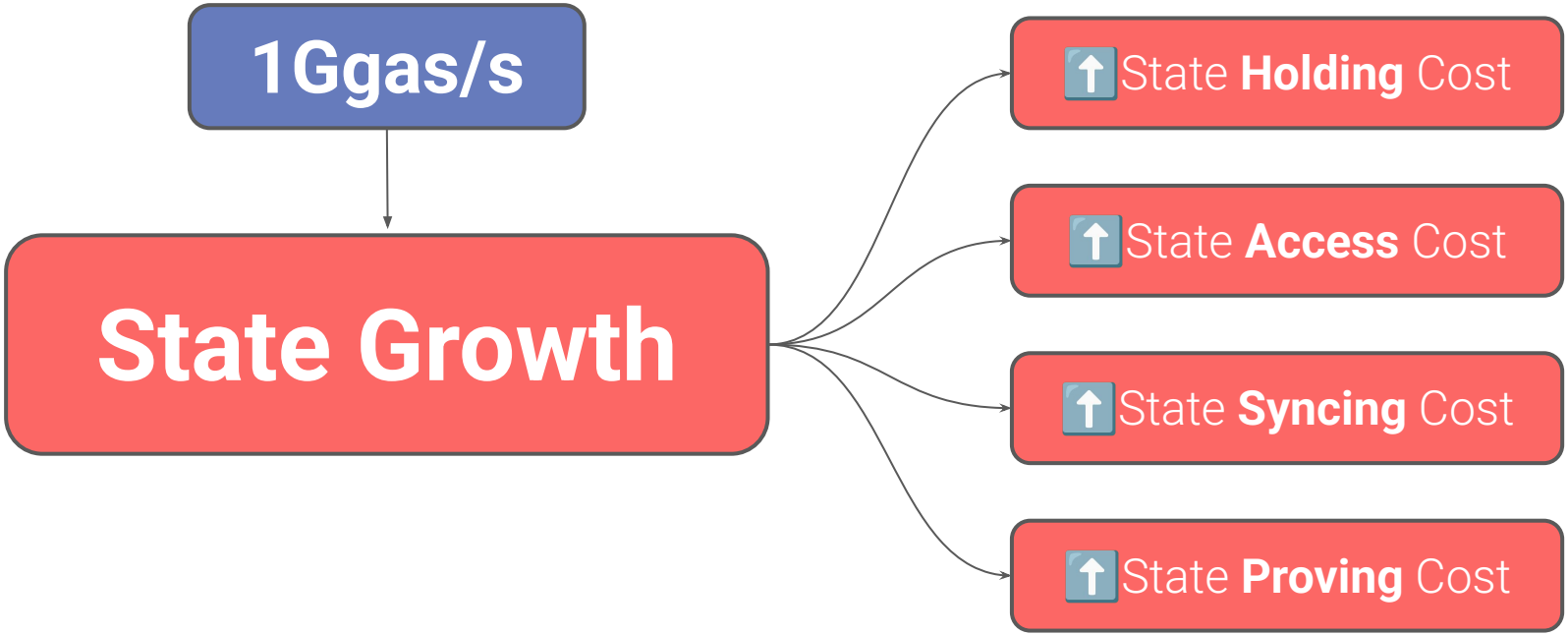
Top 500 deployers deploy **57% of contracts**.

88% of contracts have **code size <1kB** and **0.2%** are **>20kB**

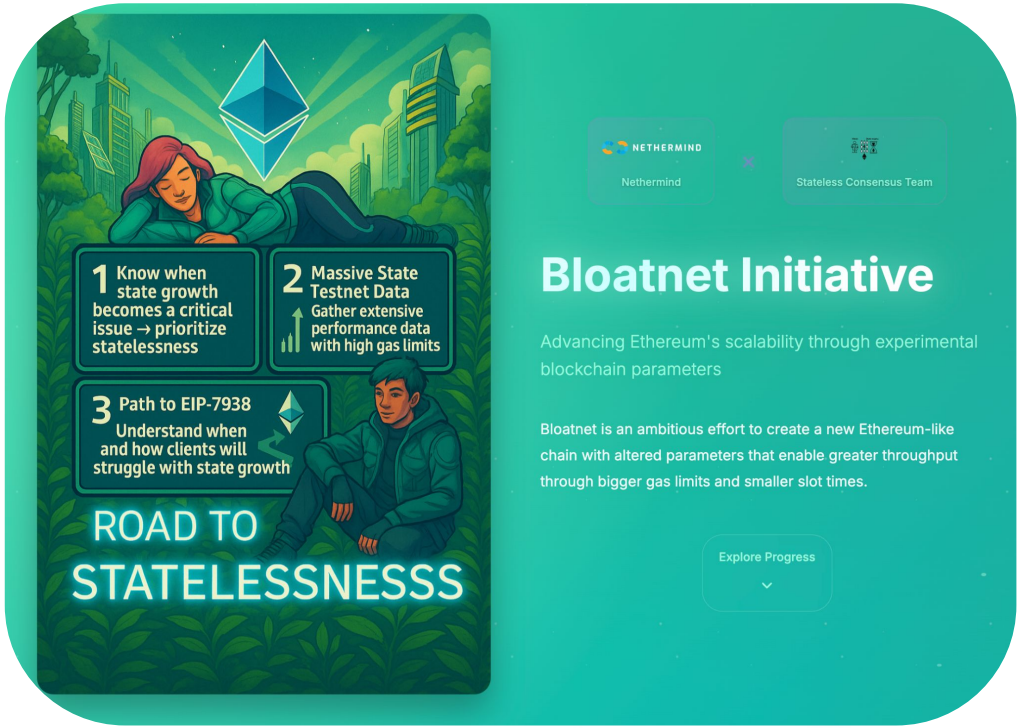
ethereum-magicians.org/t/
not-all-state-is-equal


FUTURE

L1 Scaling


1Ggas/s
State Growth
⬆️State Holding Cost
⬆️State Access Cost
⬆️State Syncing Cost
⬆️State Proving Cost

Bloatnet



bloatnet.info

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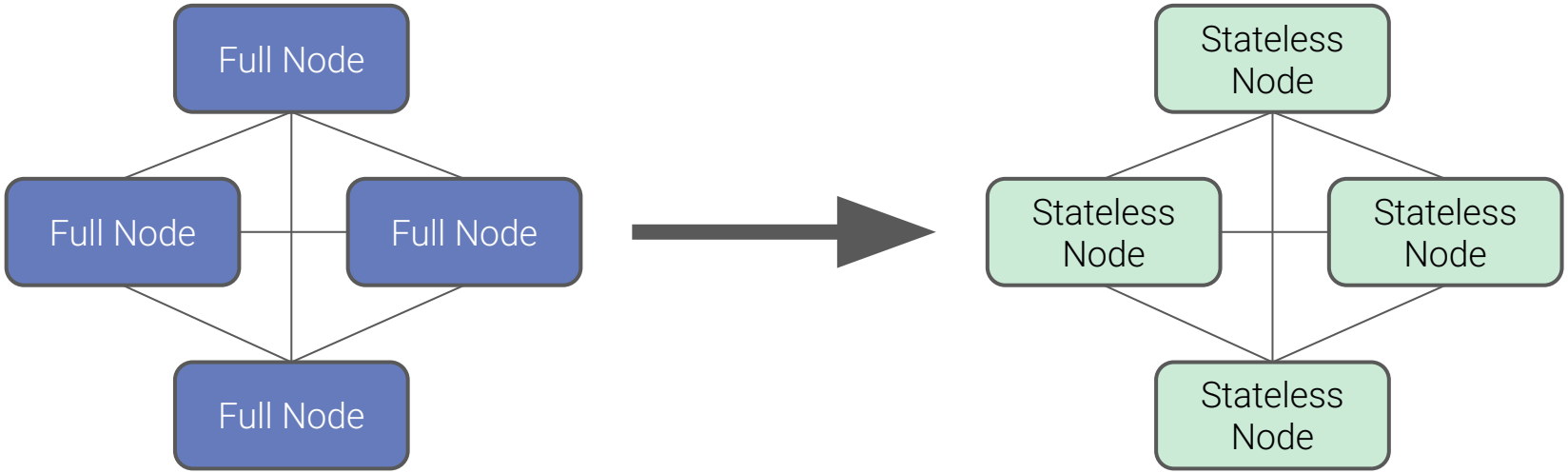
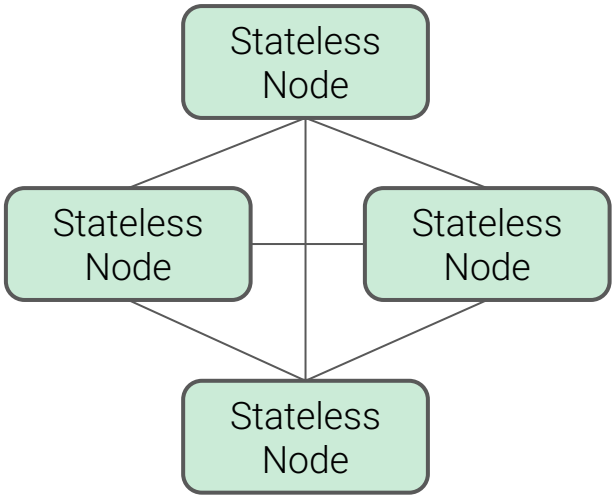
Stateless Validators



Stateless validators are inevitable for scaling.

Who holds the state?



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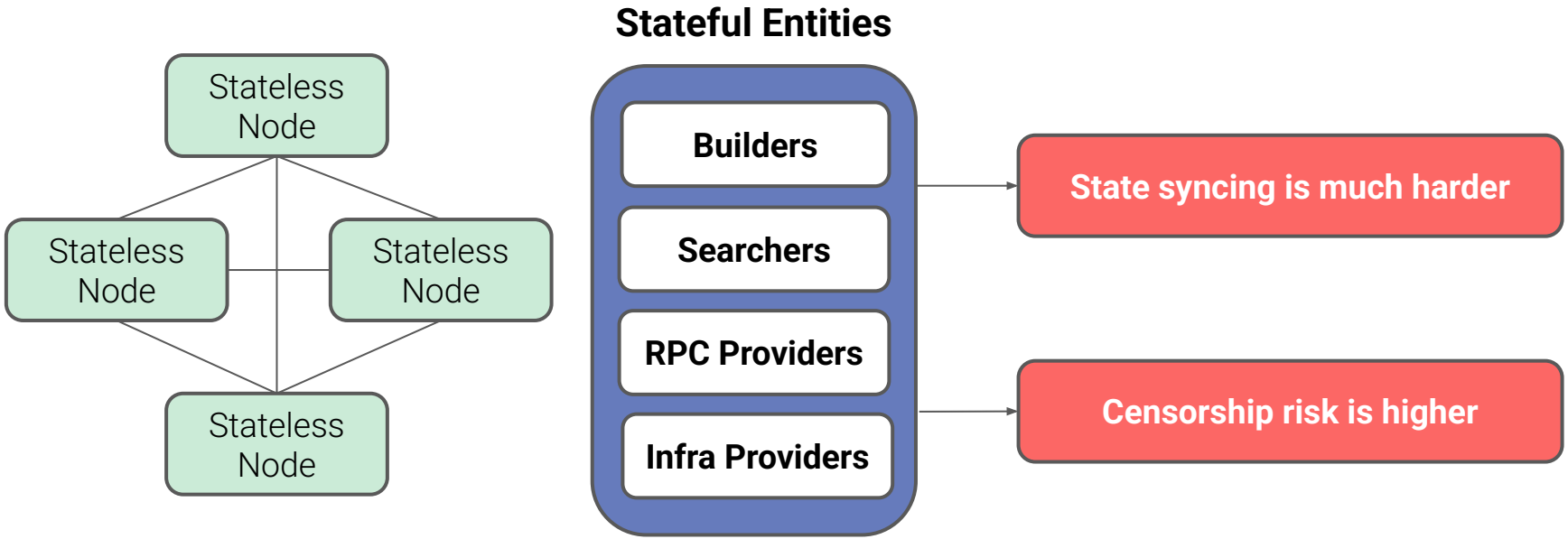
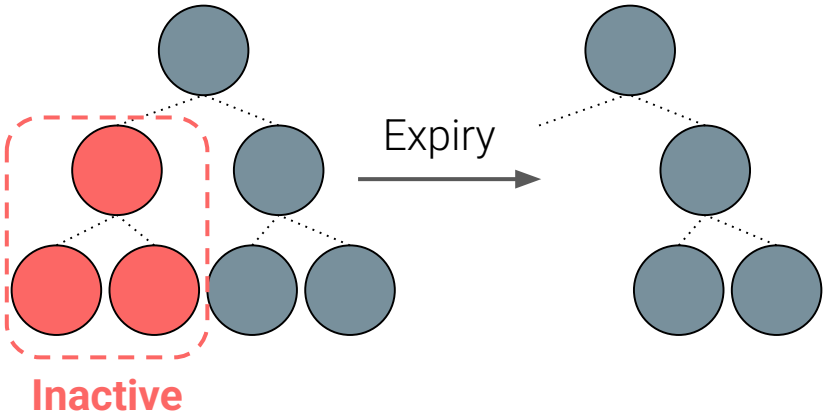


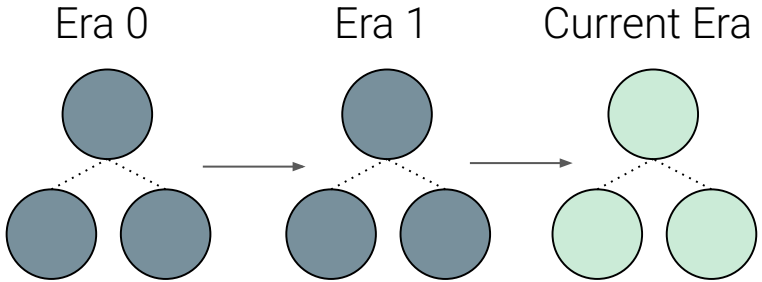
SOLUTIONS

State Expiry

Mark, Expire, Revive

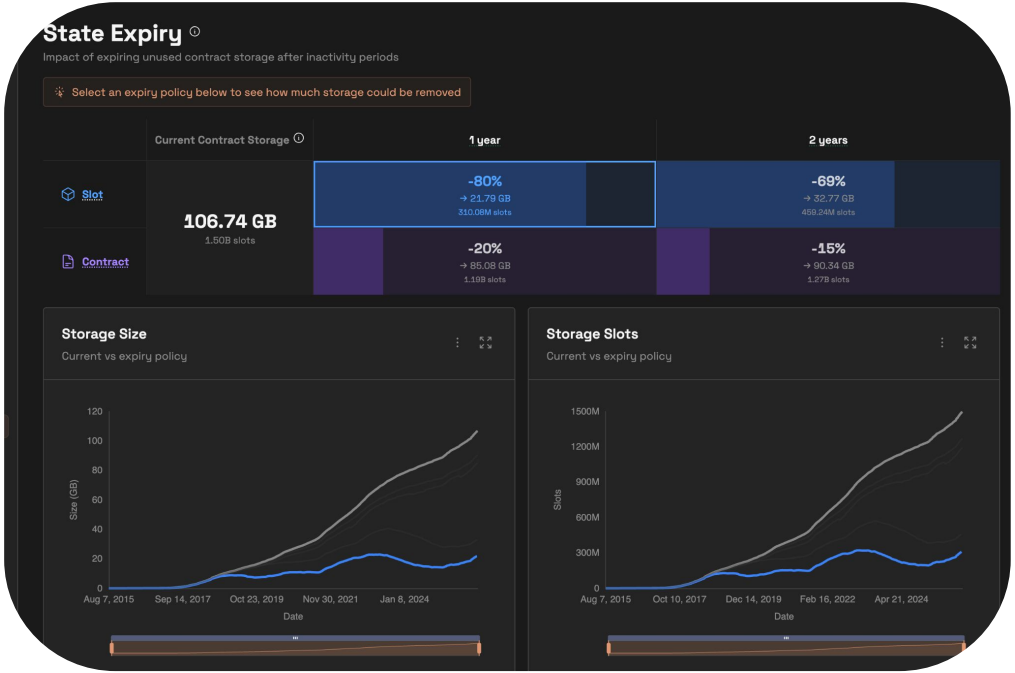


Multi-era Expiry



Remove inactive state and allow users to revive later.

State Expiry



lab.ethpandaops.io/ethereum/execution/state-expiry

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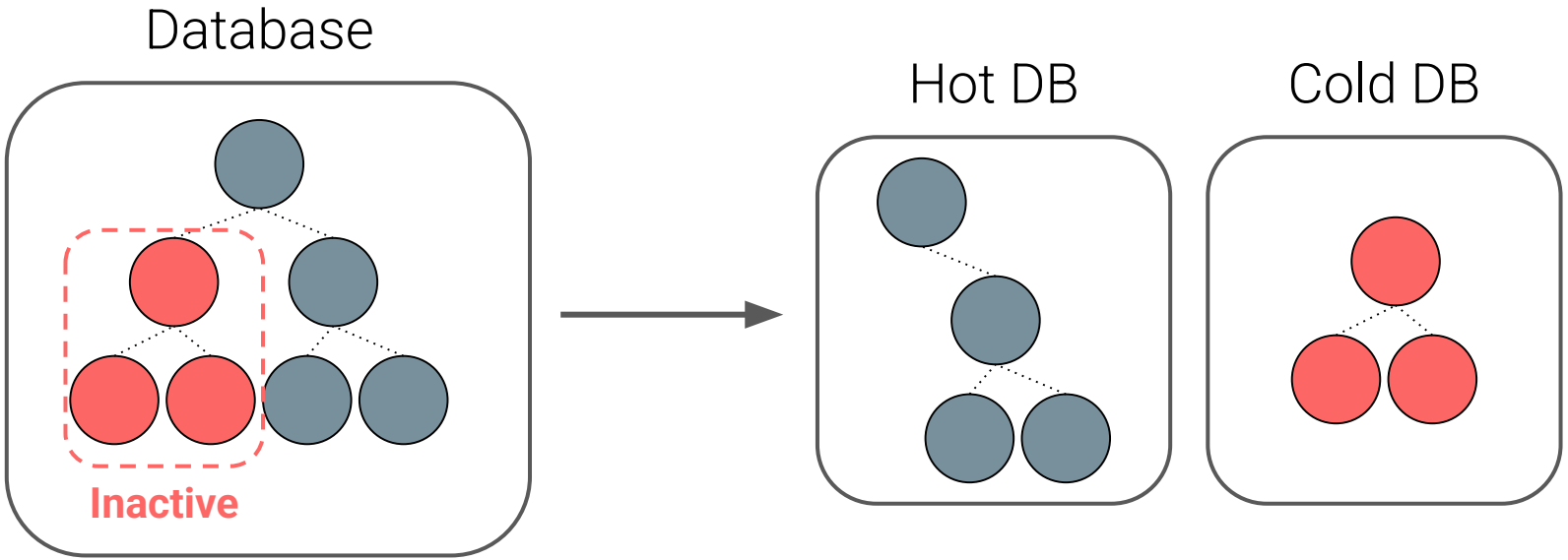
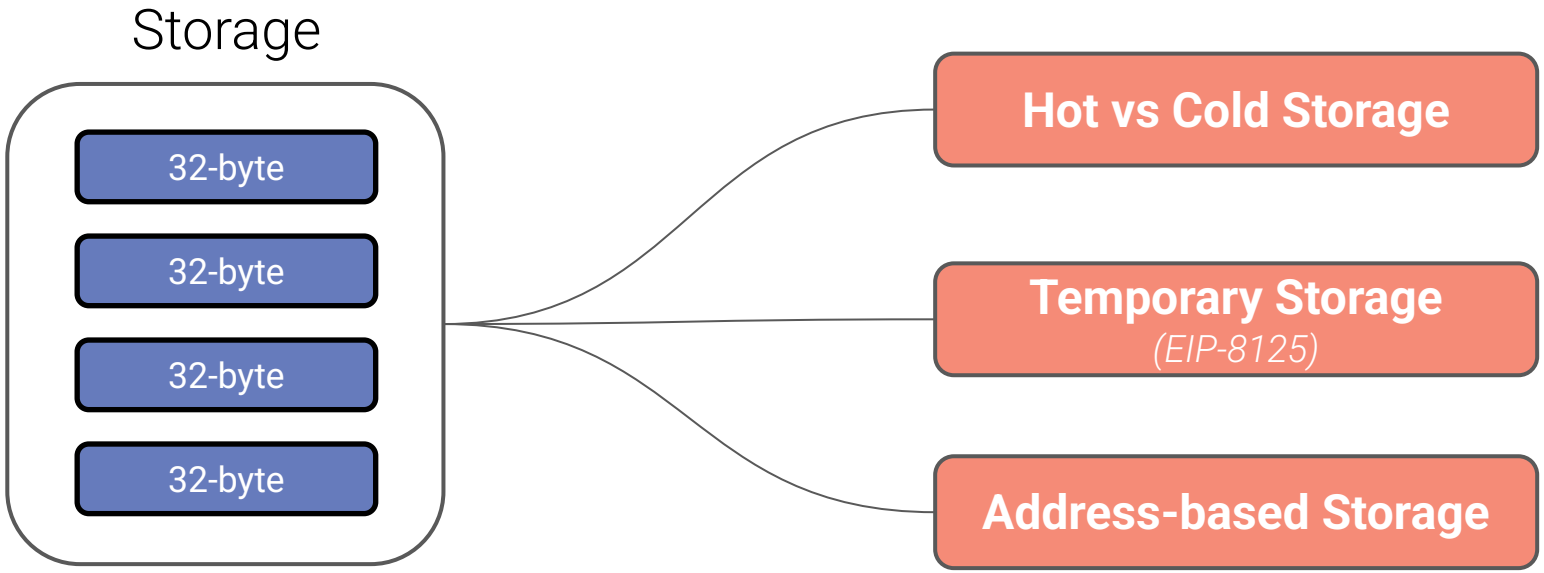
State Archive



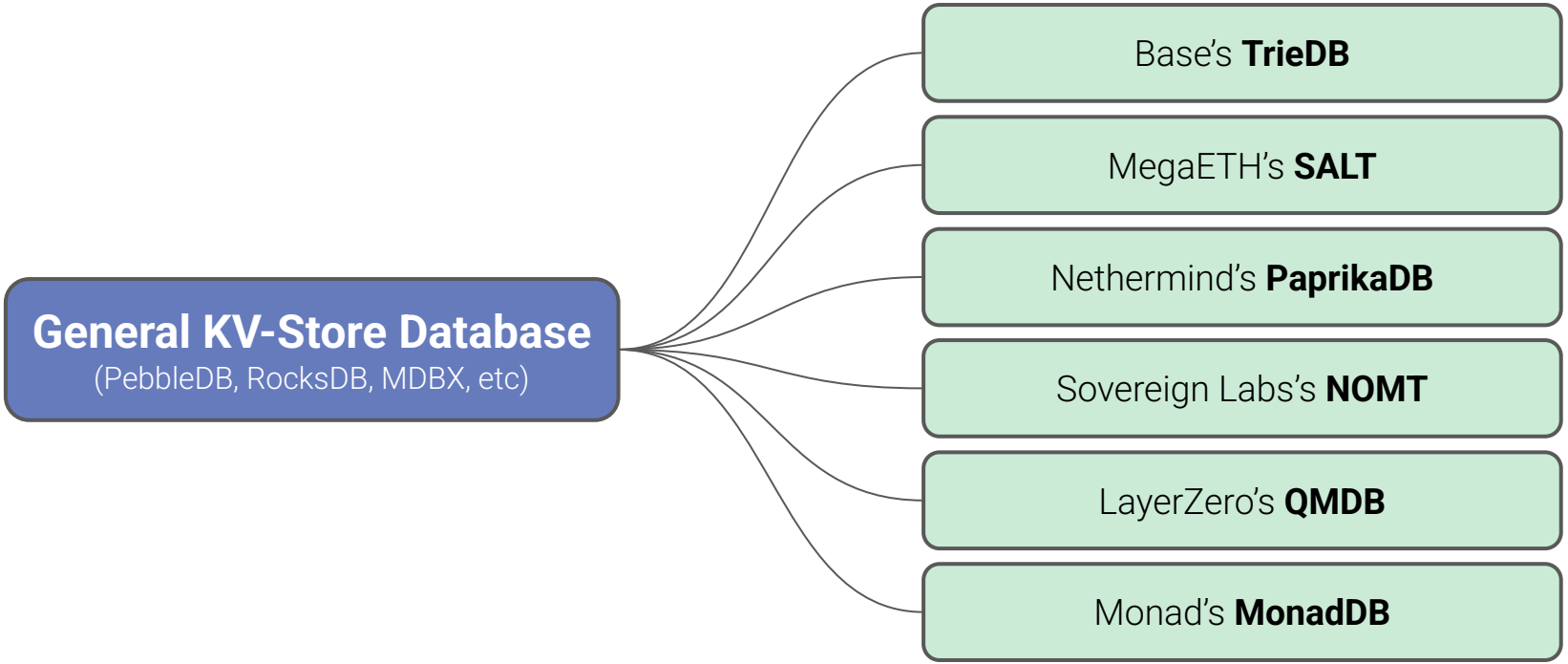
Decouple state access cost from state growth.

State Separation



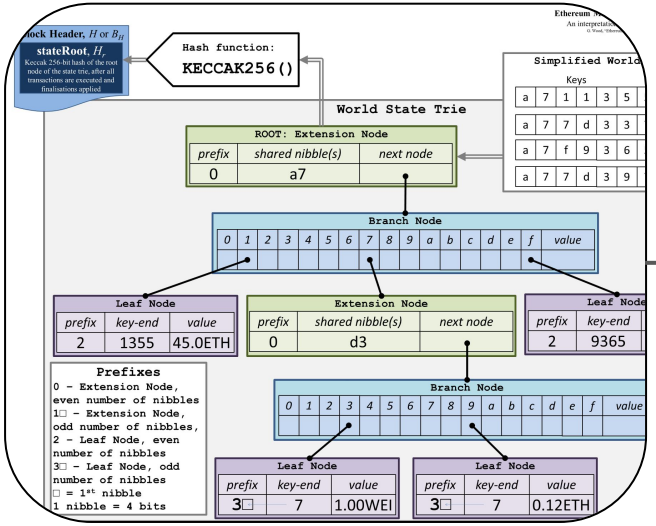
Optimize protocol's state layout for real-world usage.

Custom-built Databases

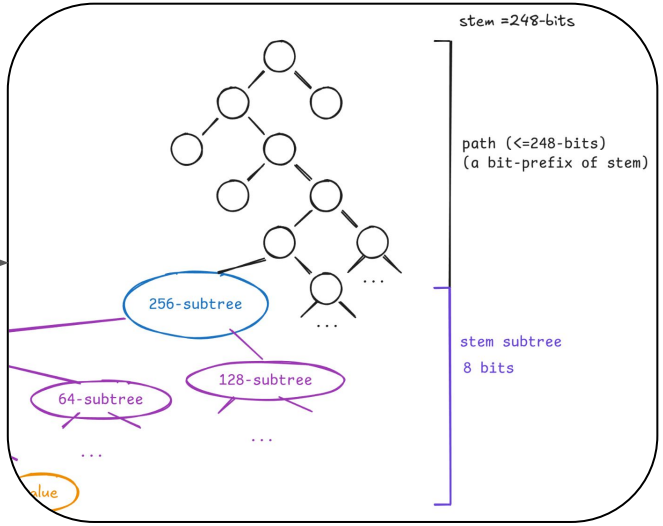


Tree Change

MPT



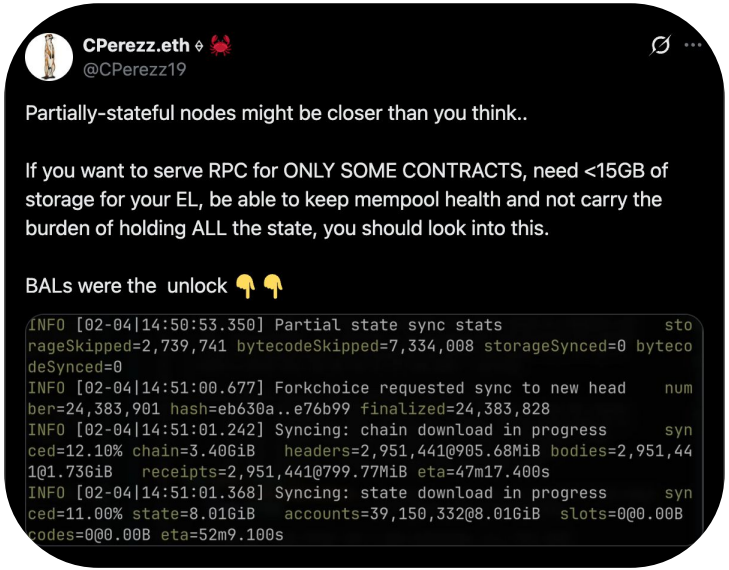
Binary Trie (EIP-7864)



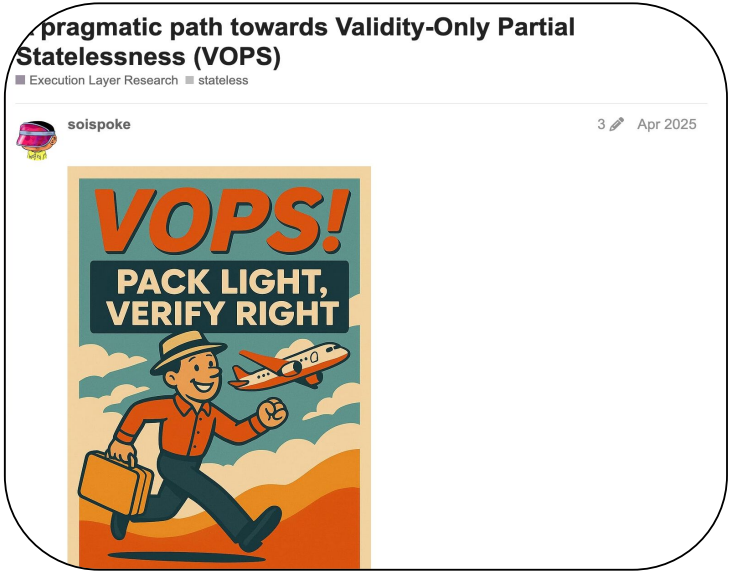
Prover-friendly, quantum-resistant, and locality-optimized.

Partial Statelessness

Light Client + Snap Sync + BALs



VOPS



Hold your state, hold your coins.

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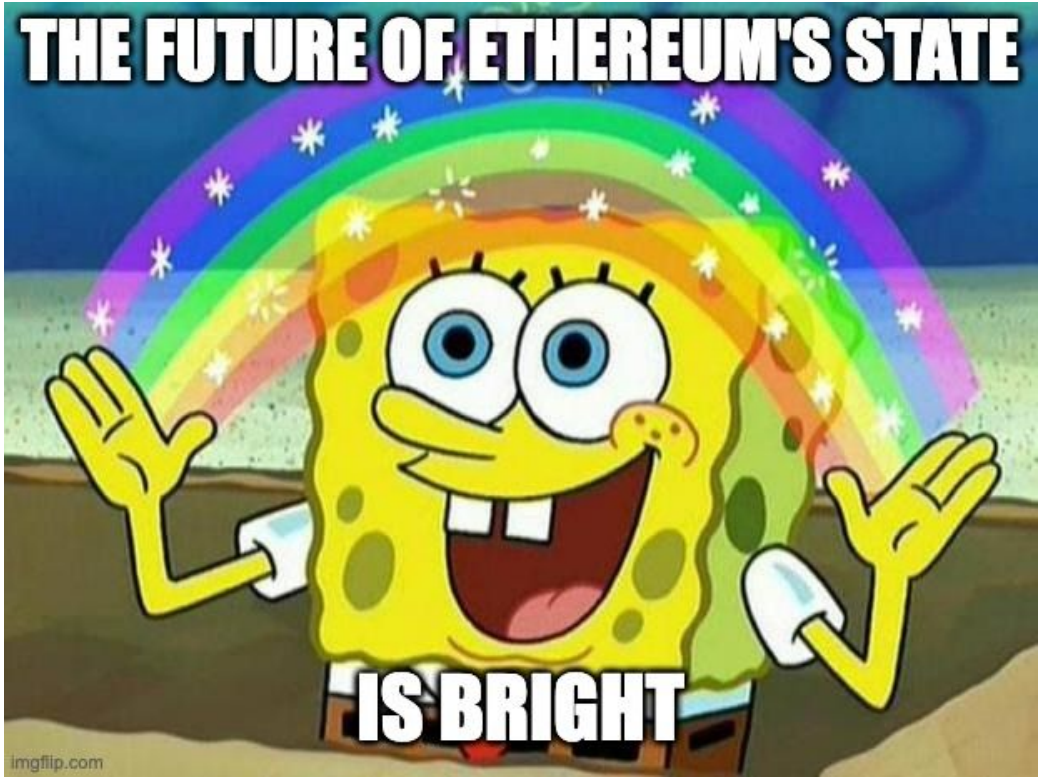
THE FUTURE OF ETHEREUM'S STATE
IS BRIGHT
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Stateless Summit (ETHCC 2026)

Apply to attend/speak!

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THANK YOU!