



# The Future of Ethereum's State

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*Stateless Consensus @ EF*



ethereum foundation  
**Stateless Consensus**



**vitalik.eth** @VitalikButerin · 8h  
Hyper-scaling Ethereum state by creating new forms of state:

[ethresear.ch/t/hyper-scalin...](https://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 entirely)
block-level access lists	<b>increase</b>
gas repricings → ~10x increase	For a few specific types (signatures, SNARKs/ aggregation could get)
improvements, dimensional gas → ~10-20x	Blocks in blobs + Peer (~500x increase)
with BALs, p2p	?
ments, database	
ments → ~5-30x increase	

Bitfield shows whether or not each UTXO has been "spent"

546 284 1.7K 153K

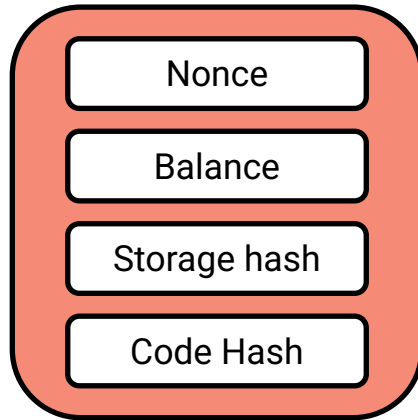


**PRESENT**

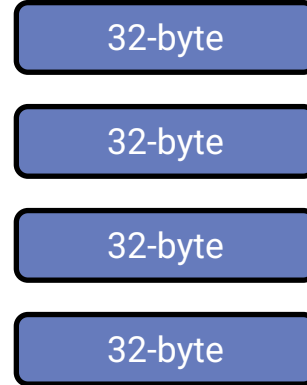


# Ethereum's state

## Accounts



## Storage Slots

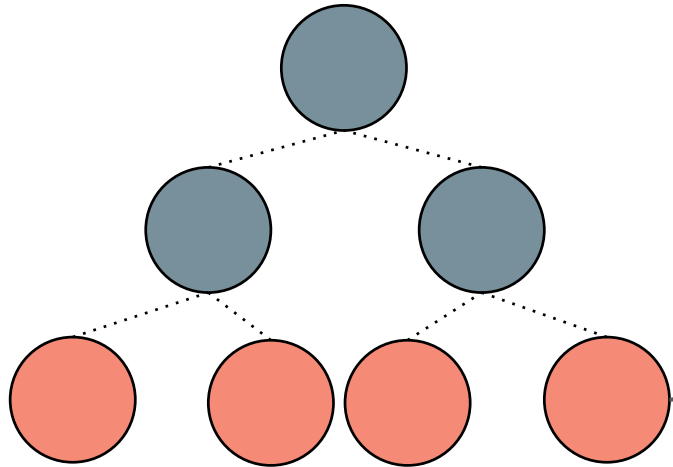


## Contract Codes

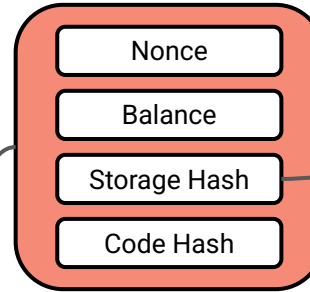


# Ethereum's state

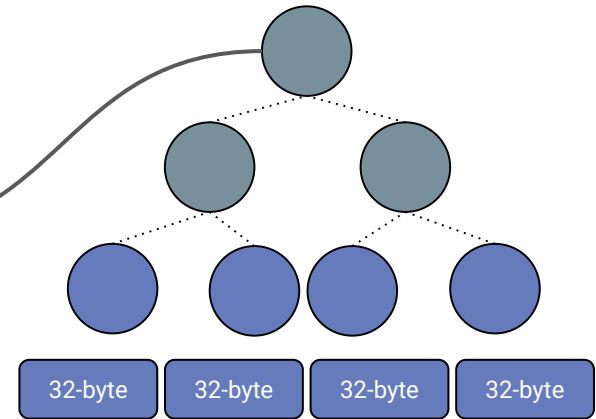
Account Trie (MPT)



Account



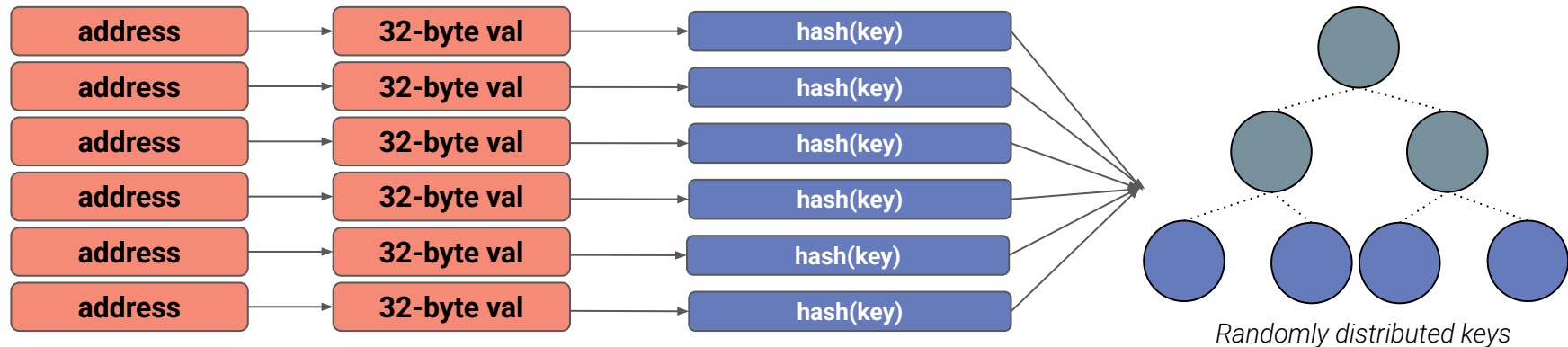
Storage Trie (MPT)



# State is inefficient for real-world pattern

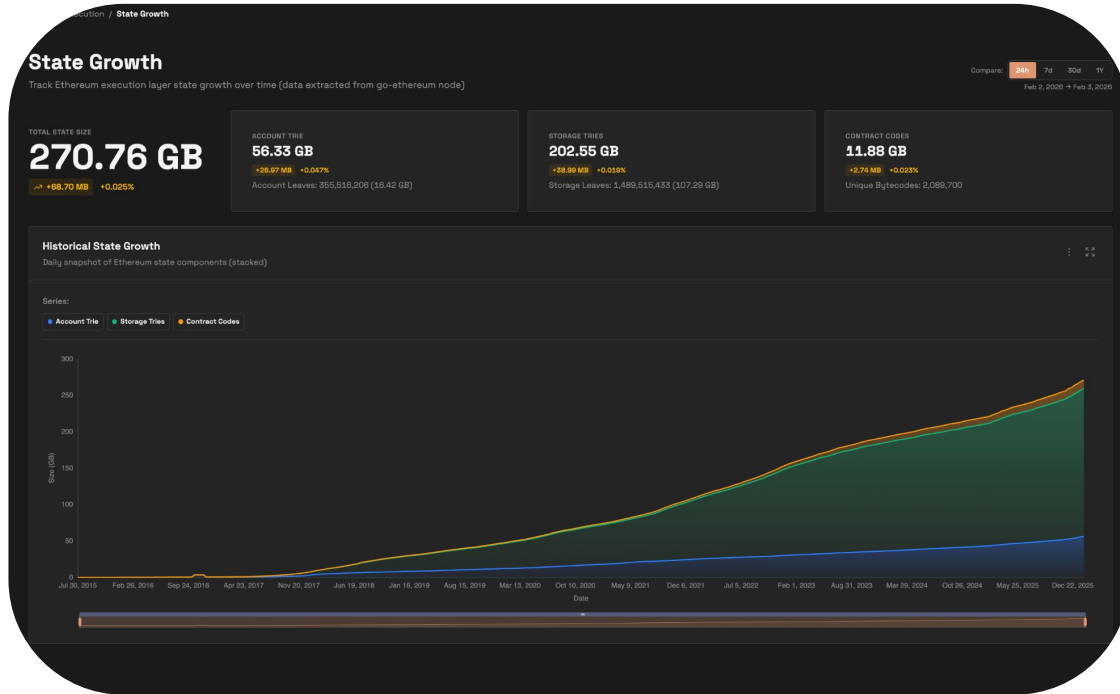
Majority of the state is

**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](https://lab.ethpandaops.io/ethereum/execution/state-growth)



# Not all state is created equal

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

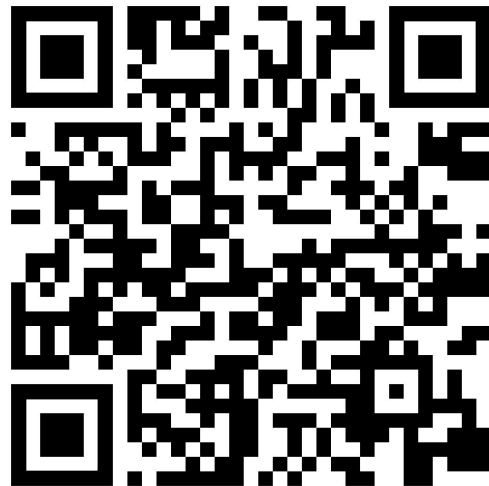
**55% of contracts** are deployed once and **never touched again**.

**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](https://ethereum-magicians.org/t/not-all-state-is-equal)



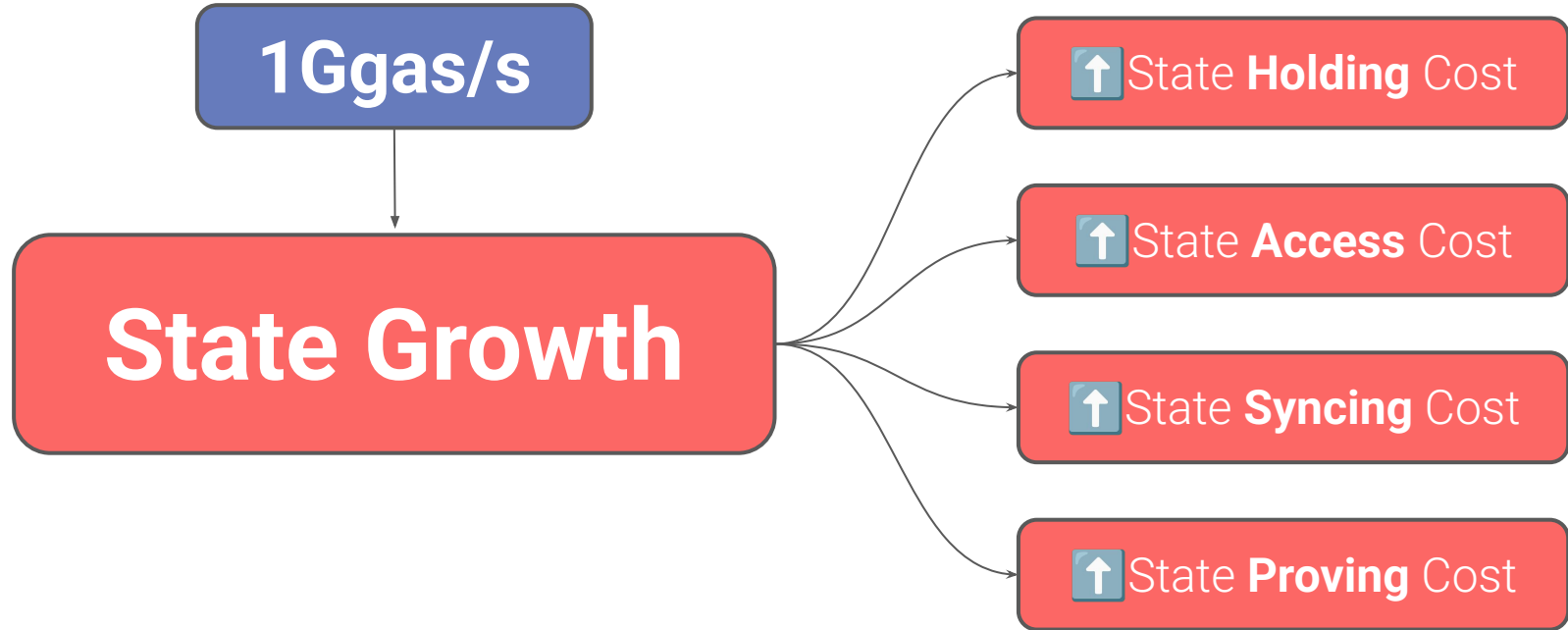




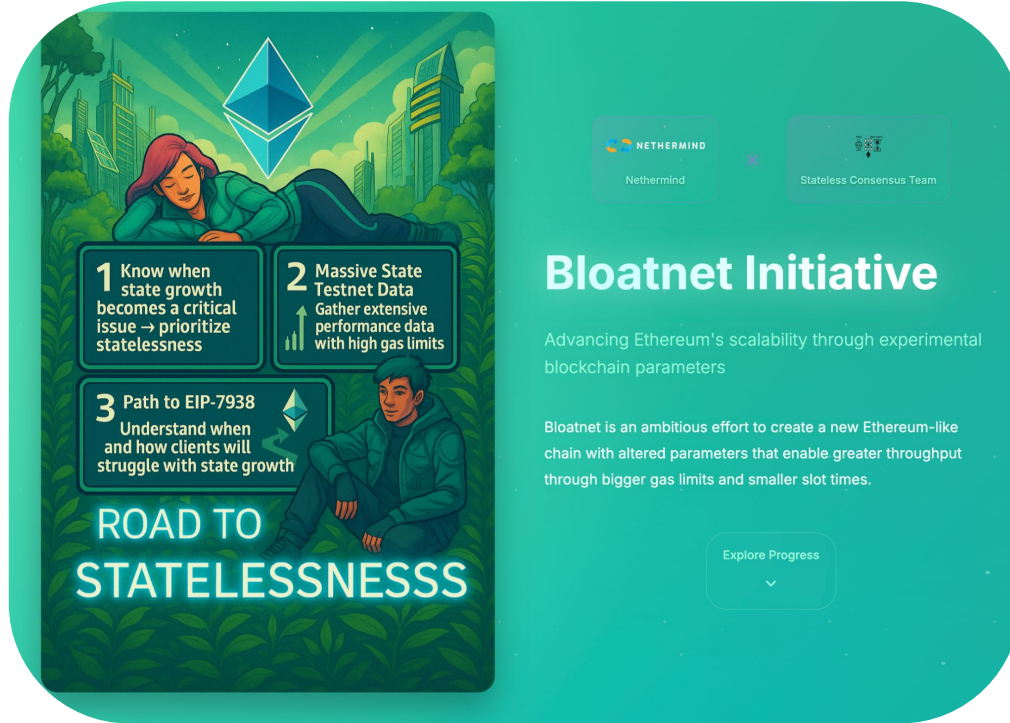
# FUTURE



# L1 Scaling



# Bloatnet

A graphic for the Bloatnet Initiative. On the left, a vertical panel with a green background and rounded corners contains three numbered steps and the title 'ROAD TO STATELESSNESS'. Step 1: 'Know when state growth becomes a critical issue → prioritize statelessness'. Step 2: 'Massive State Testnet Data Gather extensive performance data with high gas limits'. Step 3: 'Path to EIP-7938 Understand when and how clients will struggle with state growth'. The background of the panel shows a woman sleeping and a man sitting in a field with a city skyline and an Ethereum logo in the sky. To the right, a teal background features the logos for 'Nethermind' and 'Stateless Consensus Team' at the top. Below them is the title 'Bloatnet Initiative' and the text 'Advancing Ethereum's scalability through experimental blockchain parameters'. Further down is the text 'Bloatnet is an ambitious effort to create a new Ethereum-like chain with altered parameters that enable greater throughput through bigger gas limits and smaller slot times.' and a button labeled 'Explore Progress' with a downward arrow.

**1** Know when state growth becomes a critical issue → prioritize statelessness

**2** Massive State Testnet Data  
Gather extensive performance data with high gas limits

**3** Path to EIP-7938  
Understand when and how clients will struggle with state growth

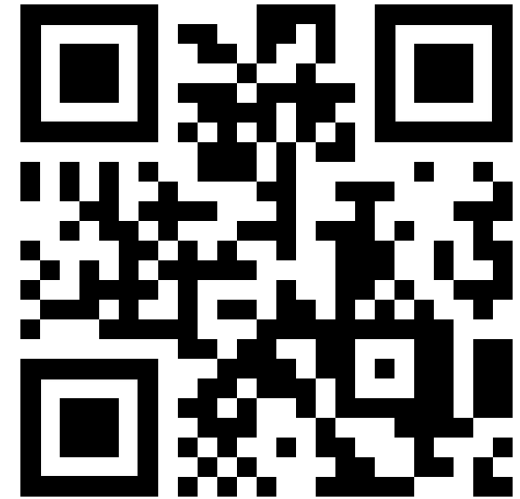
**ROAD TO STATELESSNESS**

**Bloatnet Initiative**

Advancing Ethereum's scalability through experimental blockchain parameters

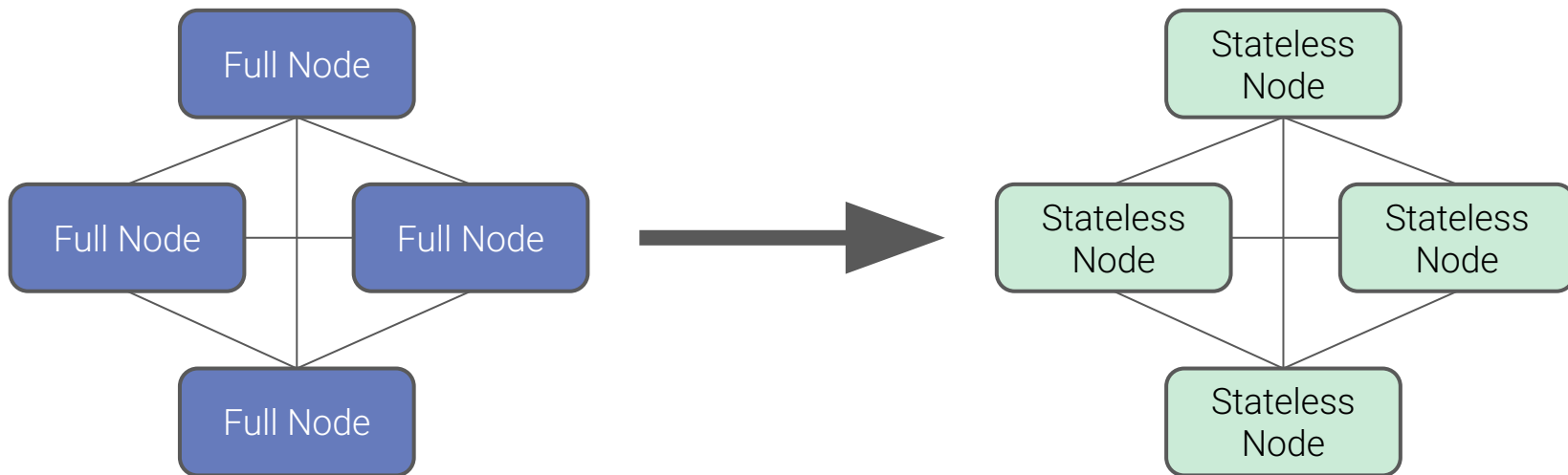
Bloatnet is an ambitious effort to create a new Ethereum-like chain with altered parameters that enable greater throughput through bigger gas limits and smaller slot times.

Explore Progress



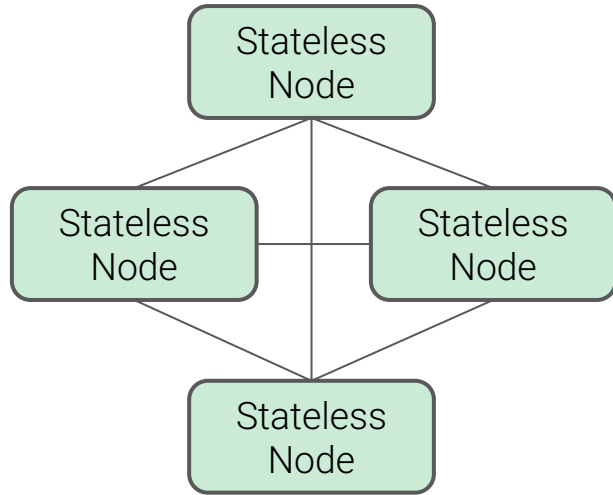
[bloatnet.info](https://bloatnet.info)

# Stateless Validators

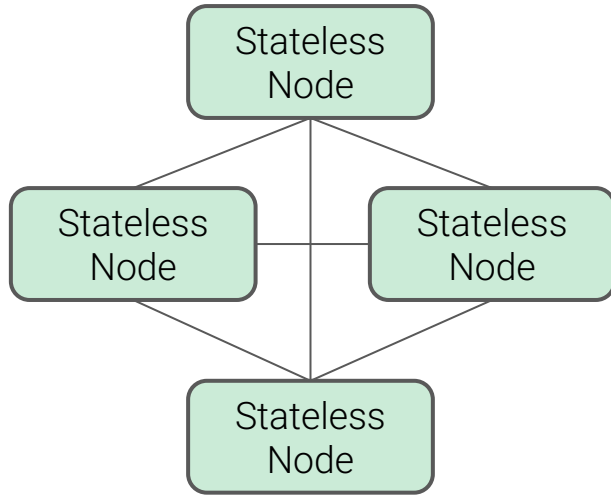


Stateless validators are inevitable for scaling.

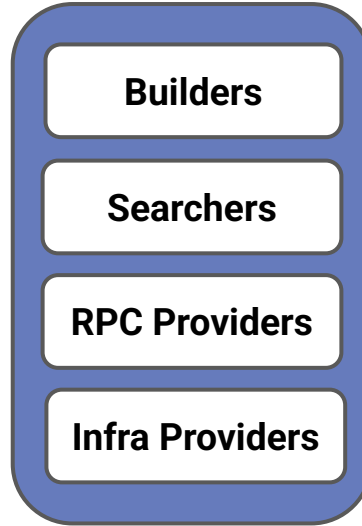
# Who holds the state?



# Who holds the state?



## Stateful Entities



State syncing is much harder

Censorship risk is higher



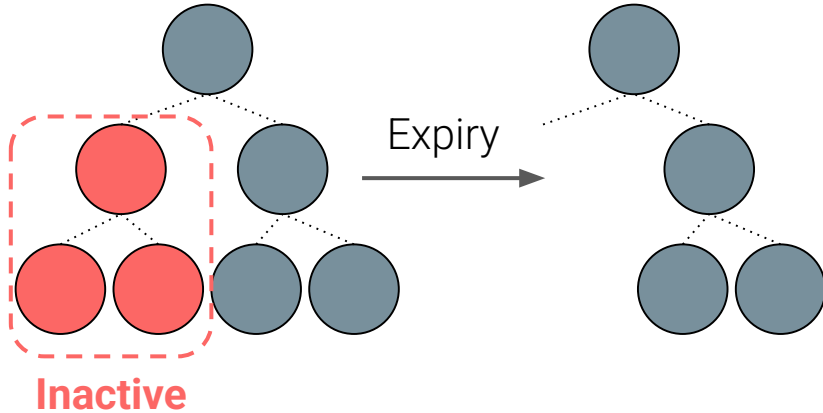


# SOLUTIONS

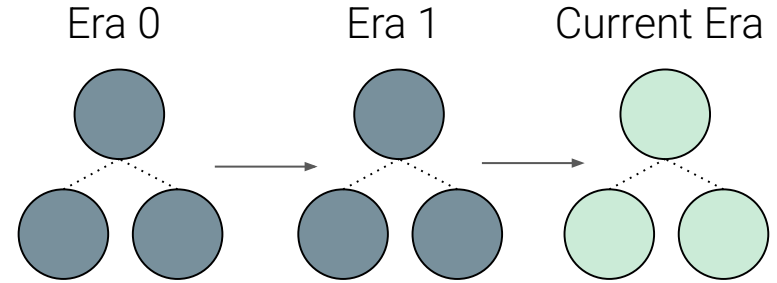


# State Expiry

Mark, Expire, Revive



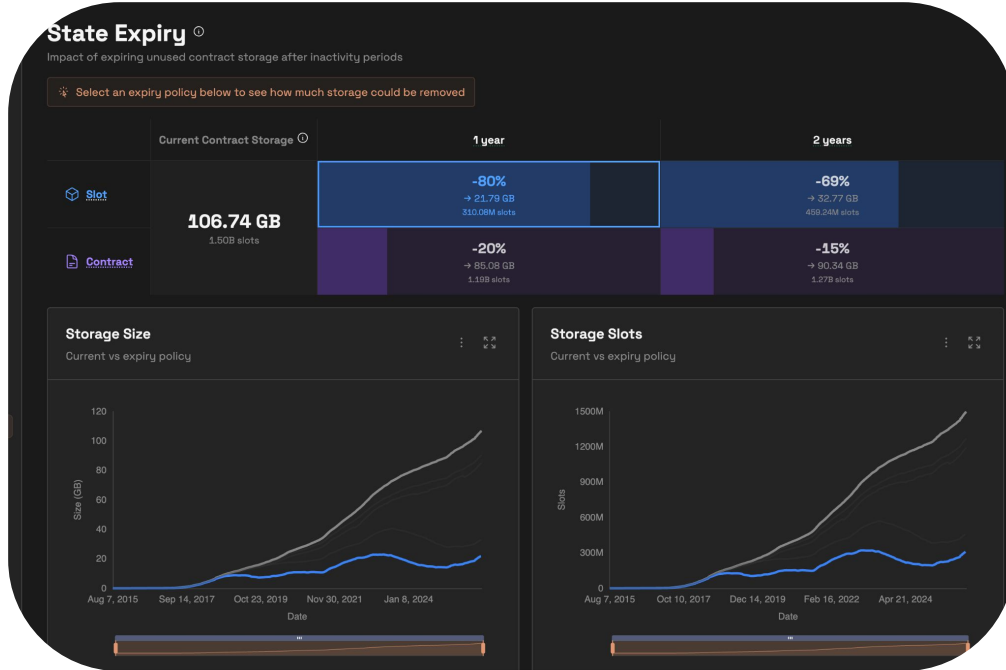
Multi-era Expiry



Remove inactive state and allow users to revive later.

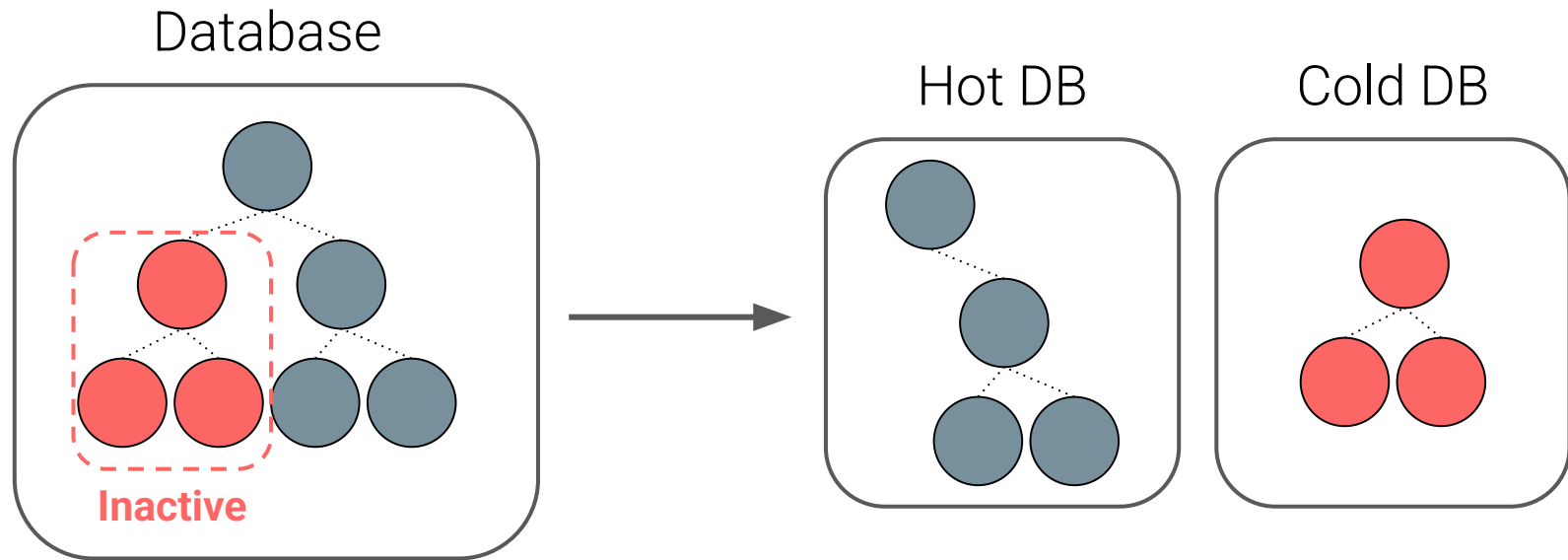


# State Expiry



[lab.ethpandaops.io/ethereum/execution/state-expiry](https://lab.ethpandaops.io/ethereum/execution/state-expiry)

# State Archive

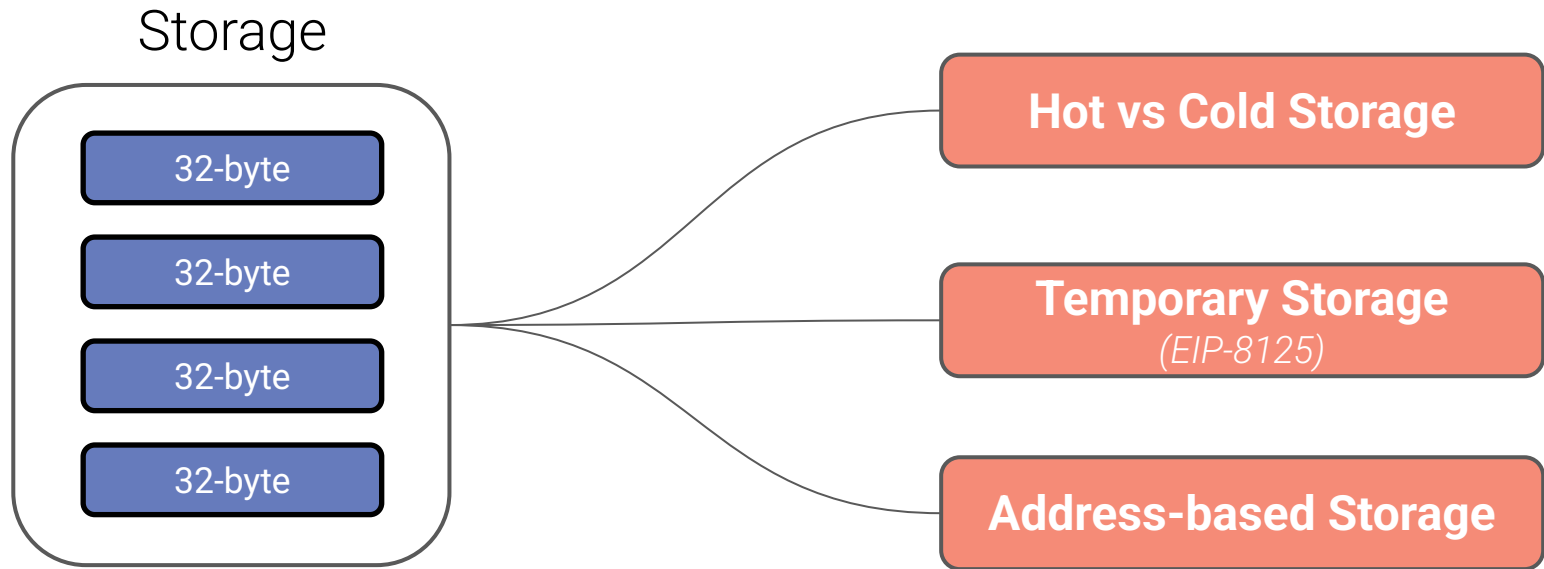


Decouple state access cost from state growth.



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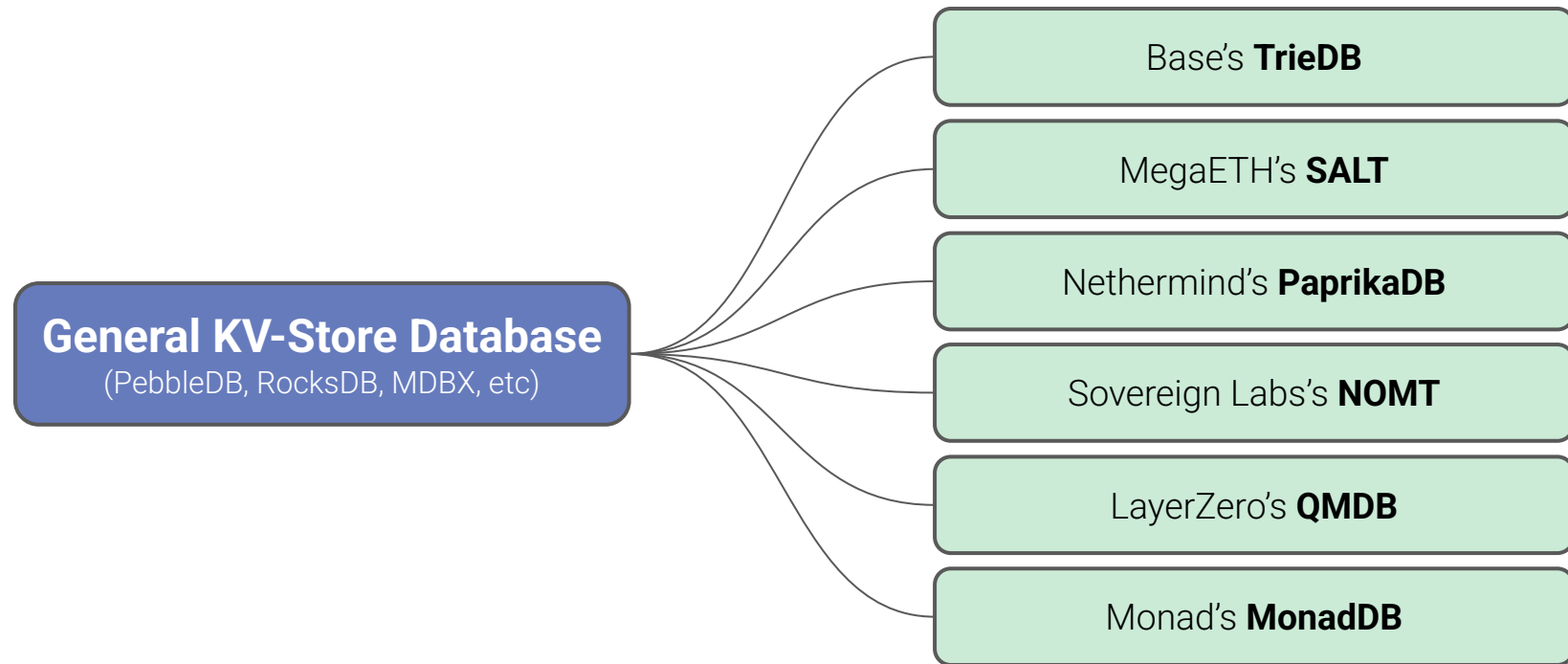
# State Separation



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

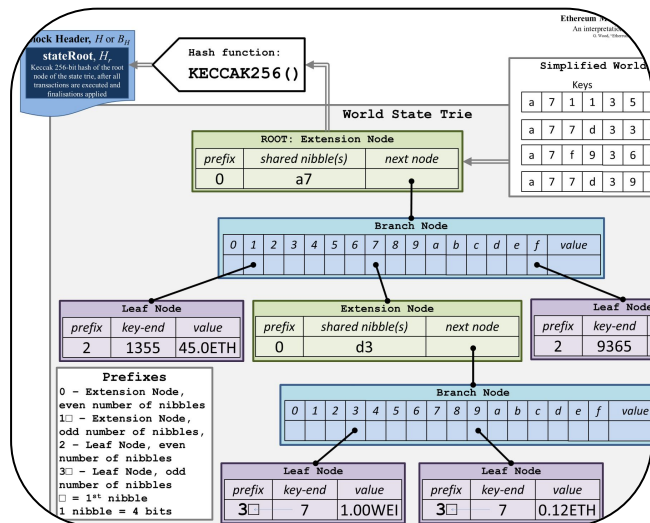


# Custom-built Databases

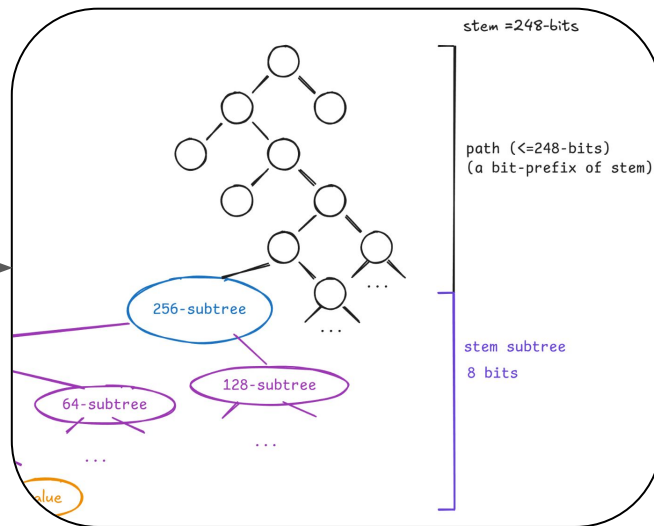


# Tree Change

## MPT



## Binary Trie (EIP-7864)



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

# Partial Statelessness

## Light Client + Snap Sync + BALs



CPerez.eth  
@CPerez19

Partially-stateful nodes might be closer than you think..

If you want to serve RPC for ONLY SOME CONTRACTS, need <15GB of storage for your EL, be able to keep mempool health and not carry the burden of holding ALL the state, you should look into this.

BALs were the unlock 🙌🙌

```
[INFO [02-04|14:50:53.350] Partial state sync stats          sto
rageSkipped=2,739,741 bytecodeSkipped=7,334,008 storageSynced=0 byteco
deSynced=0
INFO [02-04|14:51:00.677] Forkchoice requested sync to new head    num
ber=24,383,901 hash=eb630a..e76b99 finalized=24,383,828
INFO [02-04|14:51:01.242] Syncing: chain download in progress      syn
ced=12.10% chain=3.40GiB  headers=2,951,441@905.68MiB bodies=2,951,44
1@1.73GiB  receipts=2,951,441@799.77MiB eta=47m17.400s
INFO [02-04|14:51:01.368] Syncing: state download in progress      syn
ced=11.00% state=8.01GiB  accounts=39,150,332@8.01GiB slots=0@0.00B
codes=0@0.00B eta=52m9.100s
```

## VOPS

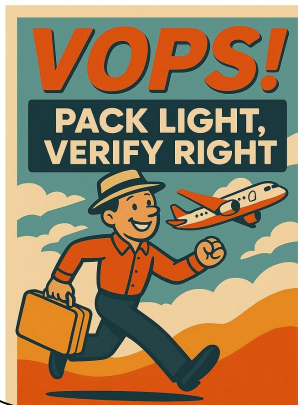
### pragmatic path towards Validity-Only Partial Statelessness (VOPS)

Execution Layer Research   stateless



solspoke

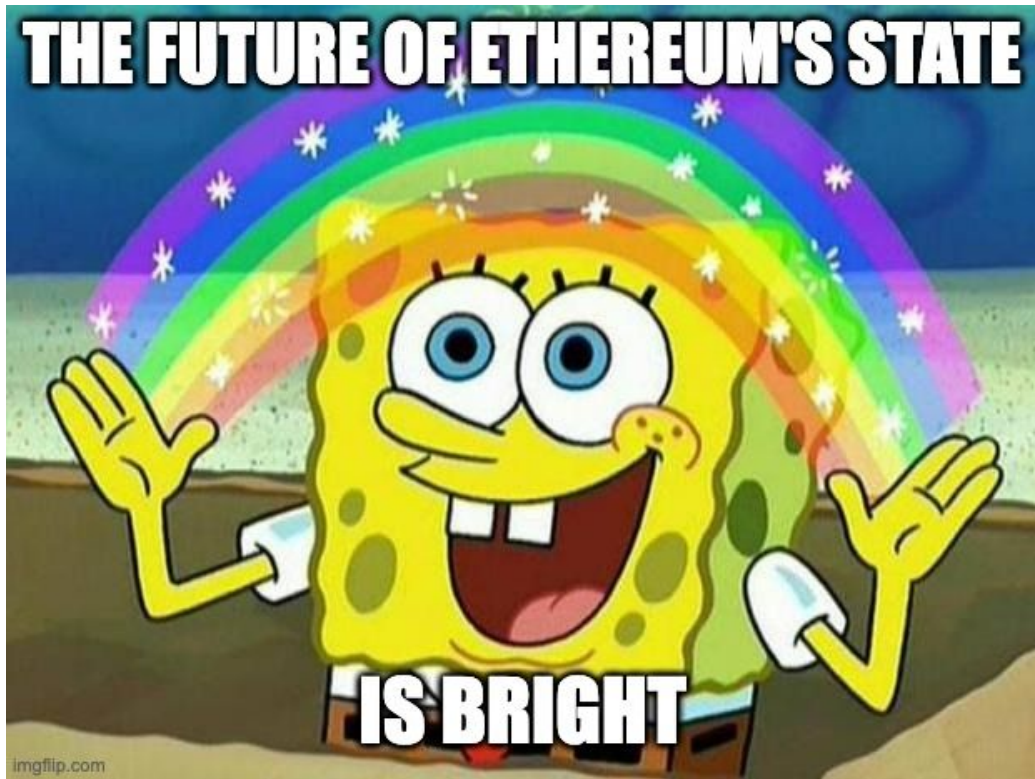
3   Apr 2025



Hold your state, hold your coins.





ethereum foundation  
**Stateless Consensus**



# Stateless Summit (ETHCC 2026)

## Stateless Summit 2026



### Stateless Summit

The Stateless Summit is a one-day event planned during EthCC 2026 for in-depth sessions on Stateless Ethereum - an update to the Ethereum protocol that brings many scalability and usability features that the Ethereum community has been anticipating for a long time.

#### Basic Event Information

- 📅 Date: April 1st, 2026
- 📍 Location: Cannes, France
- 🏠 Venue: TBA
- 🗣️ Format: Talks and Panel Discussions
- 👥 Who's the event for?



Apply to attend/speak!







**THANK YOU!**

