Espresso Systems

Shared sequencing for rollups

Solidity Singapore Meetup

Sept 2023

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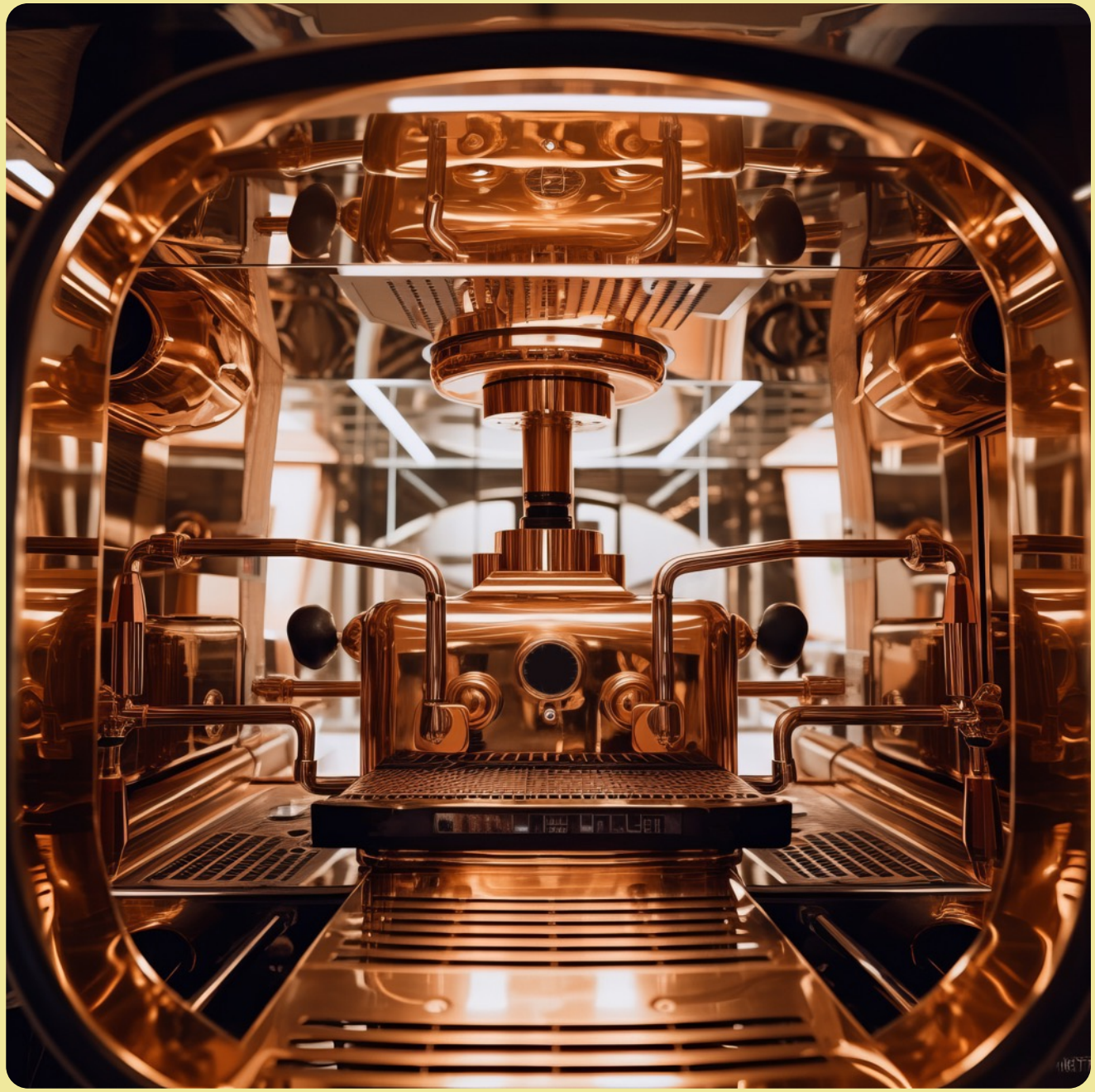
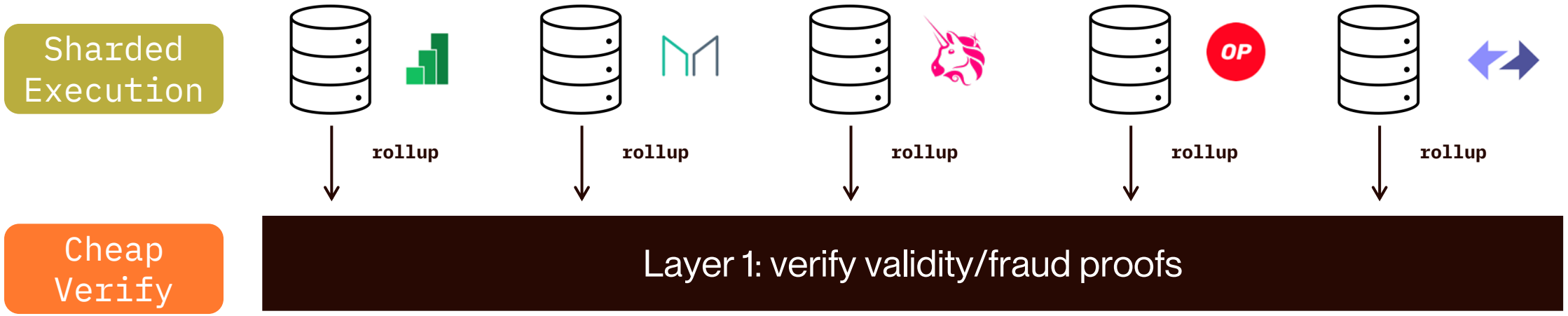


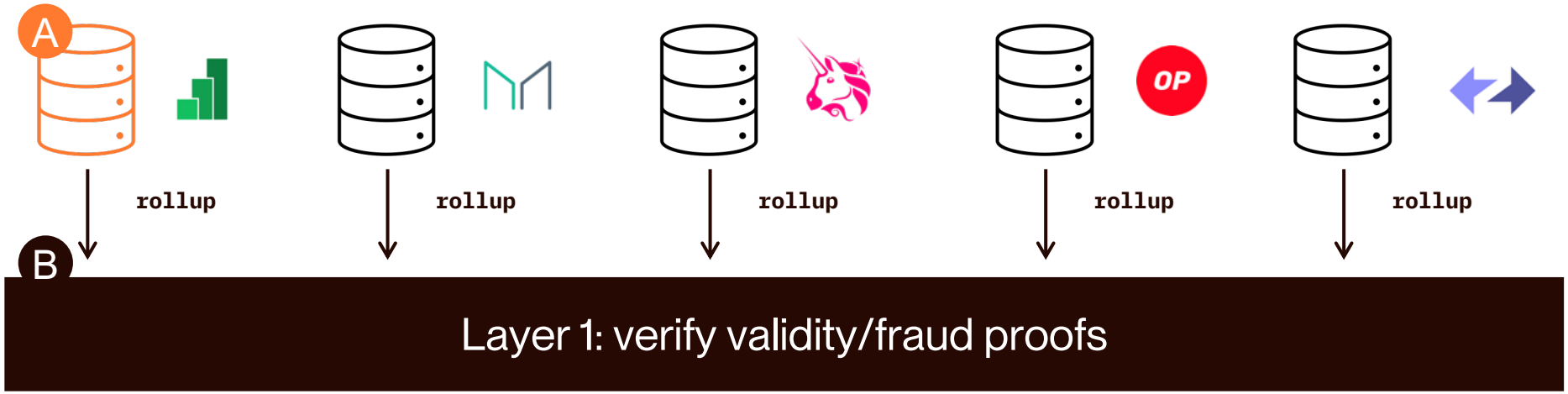
Agenda

1. Why decentralized?
2. Why shared?
3. Roughly how?
4. Demo!

Rollups: horizontal scaling



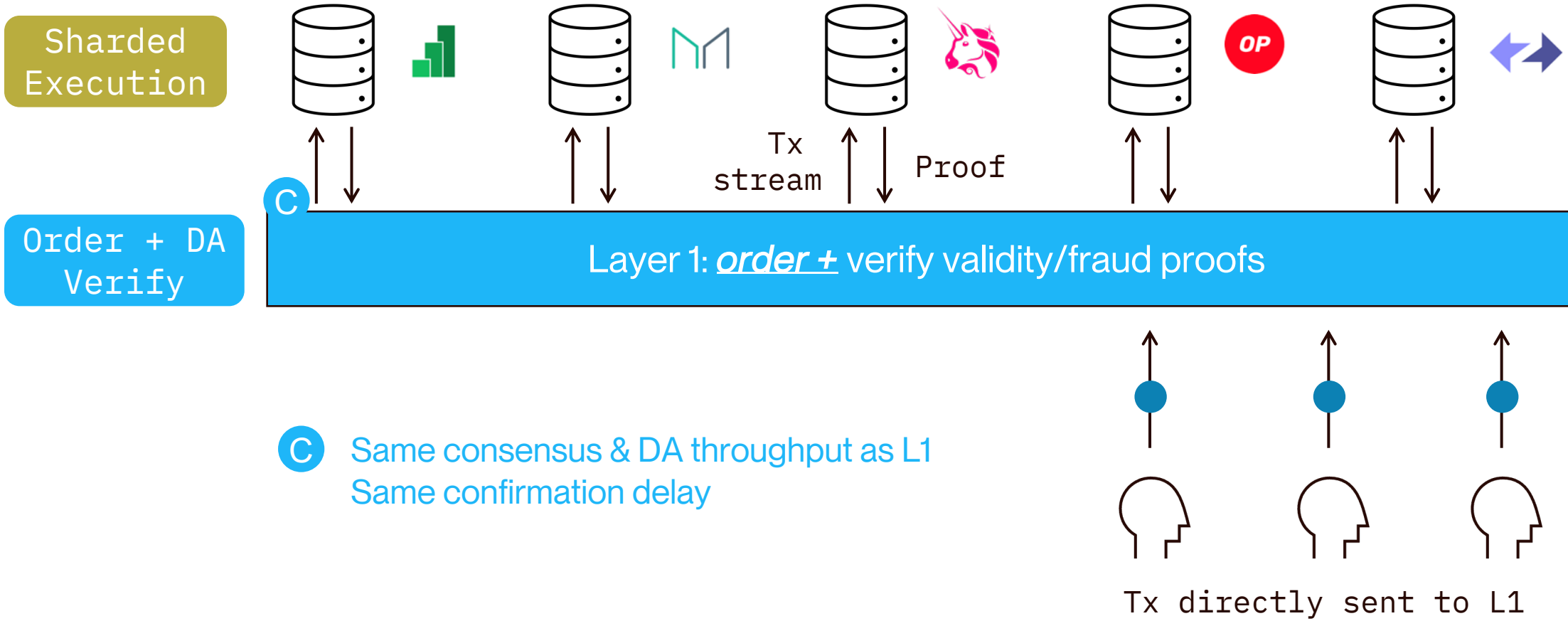
Today: Rollup servers control a lot



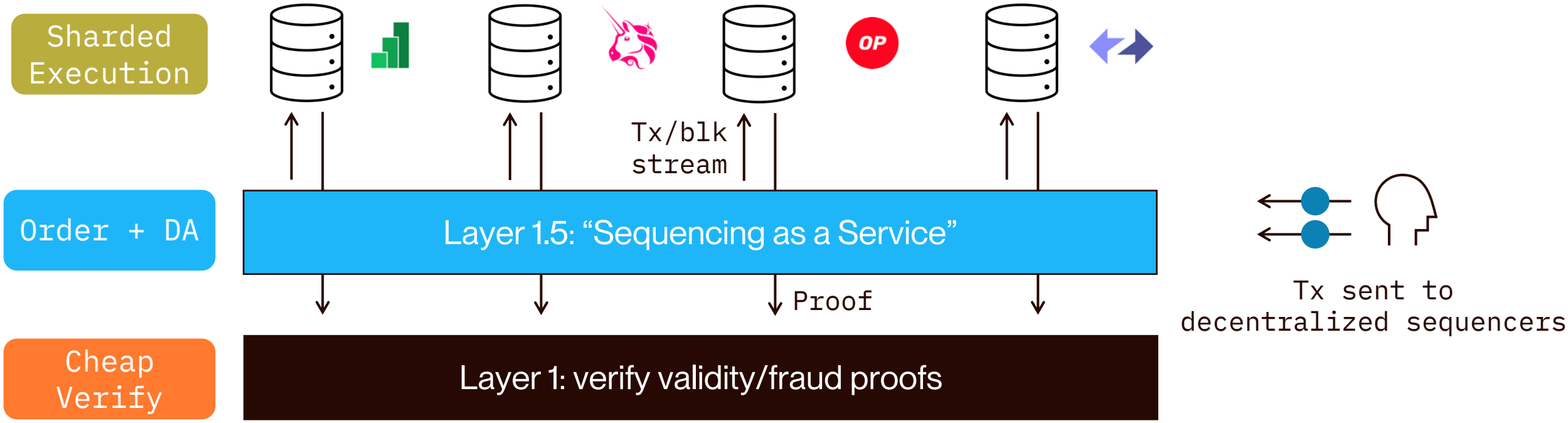
A Centralizes entire decision on
- which txs to include → `Censorship`
- in what order → `Monopolizing MEV`

B Escape Hatch can't handle
- mass exit (esp. can't slash liveness failure)
- price gouging → `Monopolistic Pricing`

“Based Rollup”: Separate ordering from execution



Specialized sequencing layer



Optionally: (duplicated) DA on L1

Reasons for a separate sequencing layer

1

Protocol **modularity**

2

Different design tradeoffs from L1 consensus*

`Fast finality v.s. Dynamically available`

3

Fast Pre-confirmations

`Choose your “settlement layer”`

`*: 12s is block time, finality gadget takes ~15 min`

Economic incentive alignment w/ L1

Flash Boys 2.0: Frontrunning, Transaction Reordering, and Consensus Instability in Decentralized Exchanges

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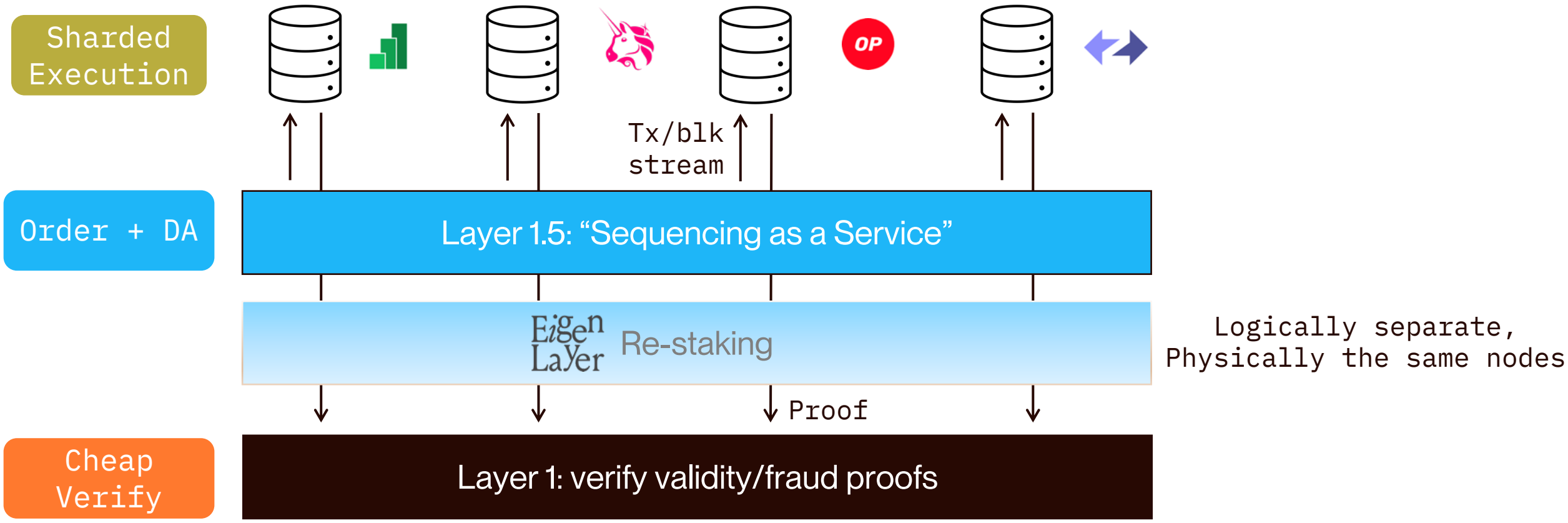
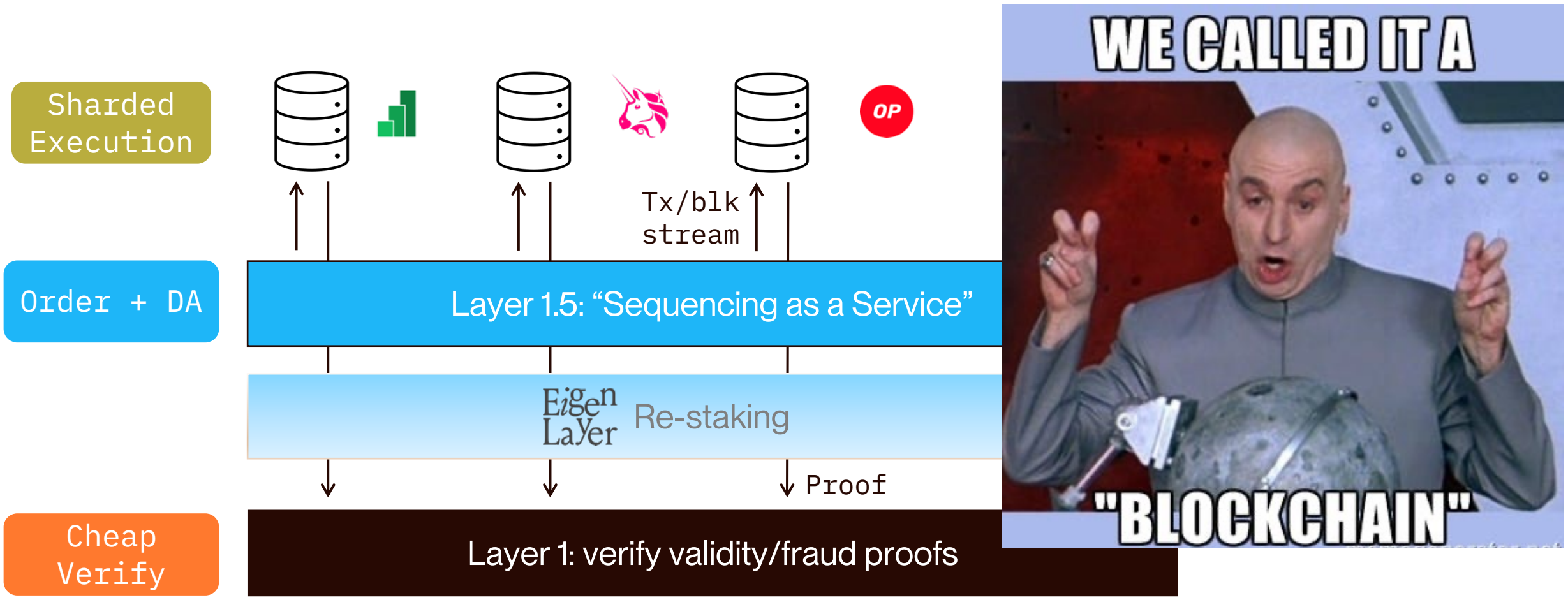
We additionally show that high fees paid for priority transaction ordering poses a systemic risk to *consensus-layer* security. We explain that such fees are just one form of a general phenomenon in DEXes and beyond—what we call *miner extractable value* (MEV)—that poses concrete, measurable, consensus-layer security risks. We show empirically that MEV poses a realistic threat to Ethereum today.

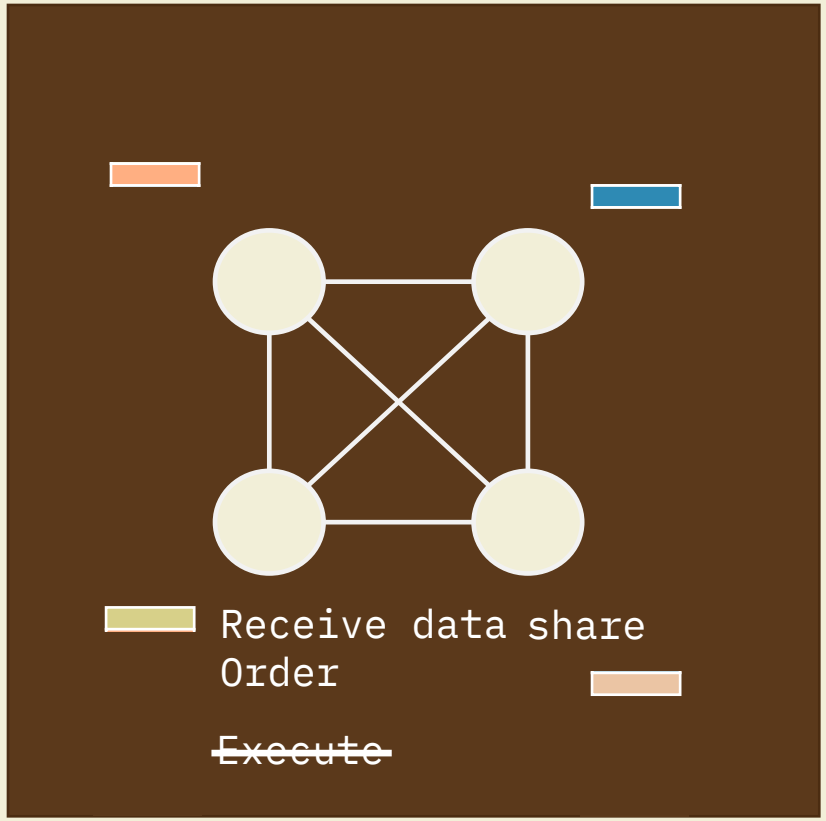
Economic incentive alignment w/ L1



Just another blockchain? Sequencing ≤ SMR!



Key Requirements for ~~SMR~~ Sequencer



~~(Data broadcast)~~ ~~Ensuring transaction data is broadcast to every non-faulty node~~

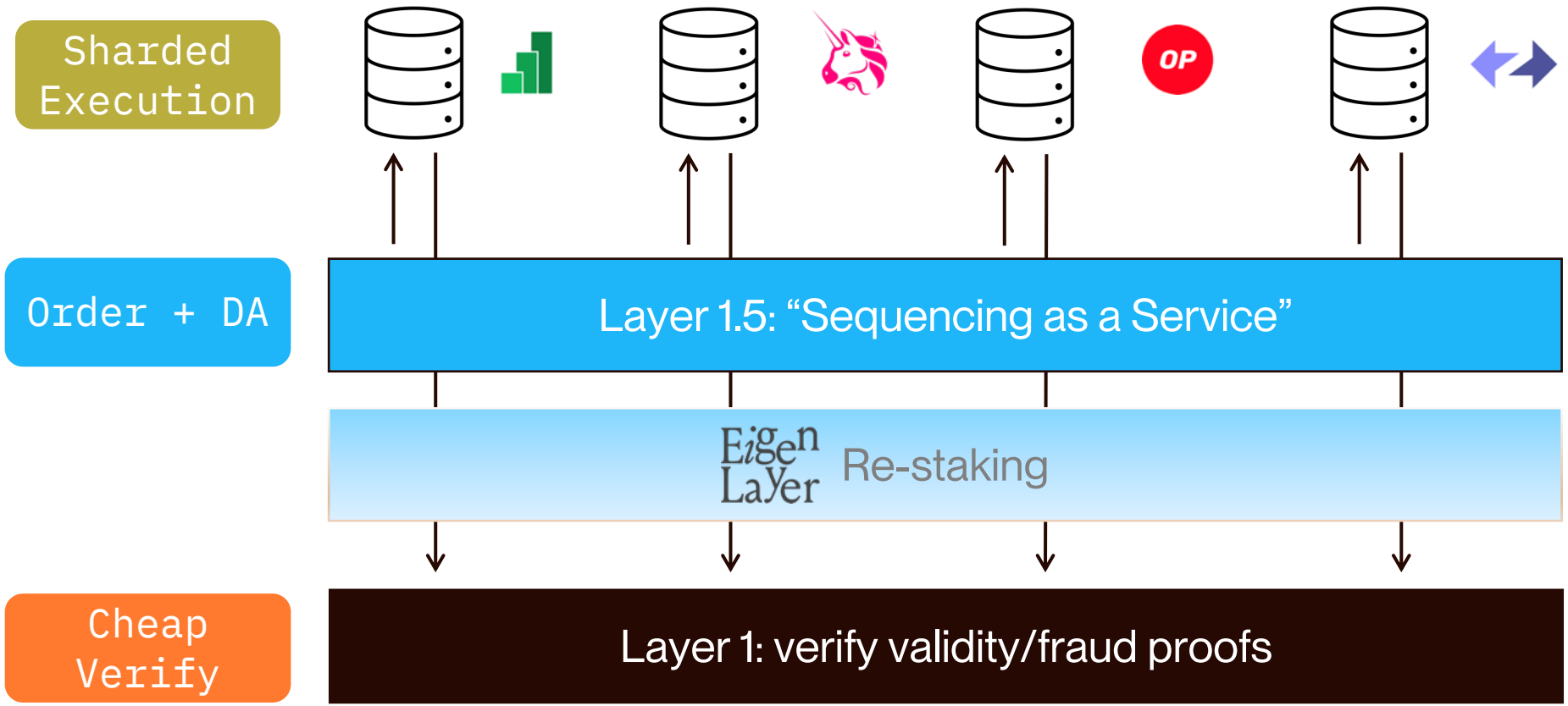
(Data availability) Ensuring availability of data to those who need it

(Consensus) Agree on the order of transactions

~~(Execution)~~ ~~Execute transactions and update state machine~~ No execution

Credit: Kartik Nayak SBC'23 Consensus Talk

Shared sequencing: no fragmentation



Three Advantages of Shared Sequencers

1

Easier bridging

2

Mitigate systemic **security risks** of bridges

3

Support **x-rollup building** with economic bonding

We only provides “**atomic inclusion**”, NOT “atomic execution”.
But this is as good as it gets w/ heterogenous exec env.

Easier bridging

Scenario 1: Siloed Sequencers

- Rollup B verifies
  inclusion of lock on rollup A &
  the validity of A's consensus
- Async, one-way

Scenario 2: Shared Sequencers

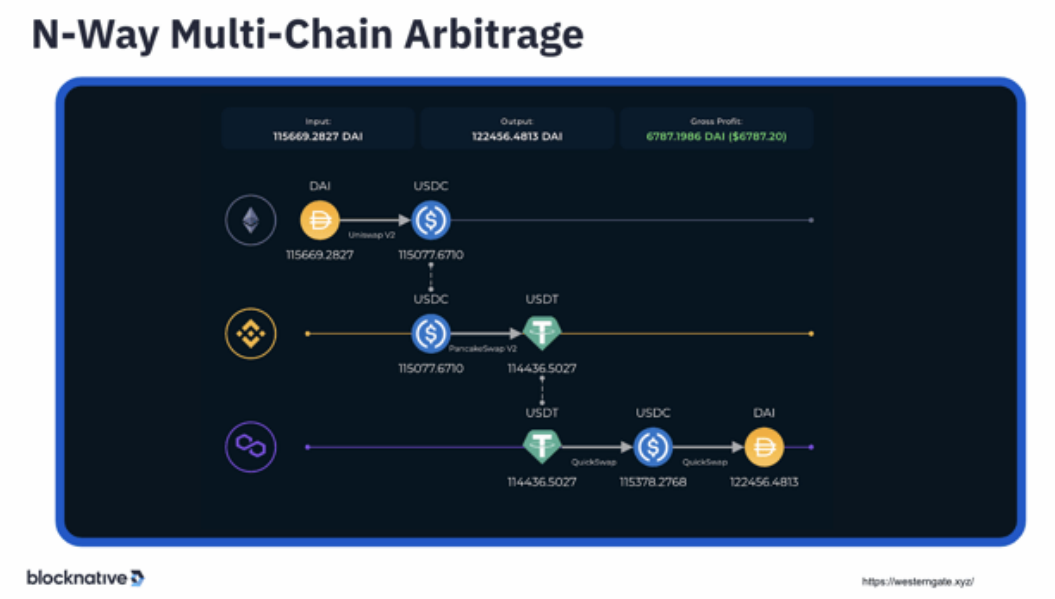
- Rollup B verifies
  inclusion of mint & lock in the same tx
  bundle
- ~Sync, two-way

Image credit: https://chaindebrief.com/blockchain-bridges-how-they-work/

Lower security risk of bridging

- **Consensus reorg** leads to double holding of locked funds
- Shared finality layer ensures **atomicity**
  - Finality is hard to violate
  - Even w/ reorg, both lock & mint are reverted

Easier X-rollup building



Scenario 1: Siloed Sequencers

- Win PBS auctions on both chains, simultaneously!
- Just be proposer simultaneously ! → higher stake required, centralization risk

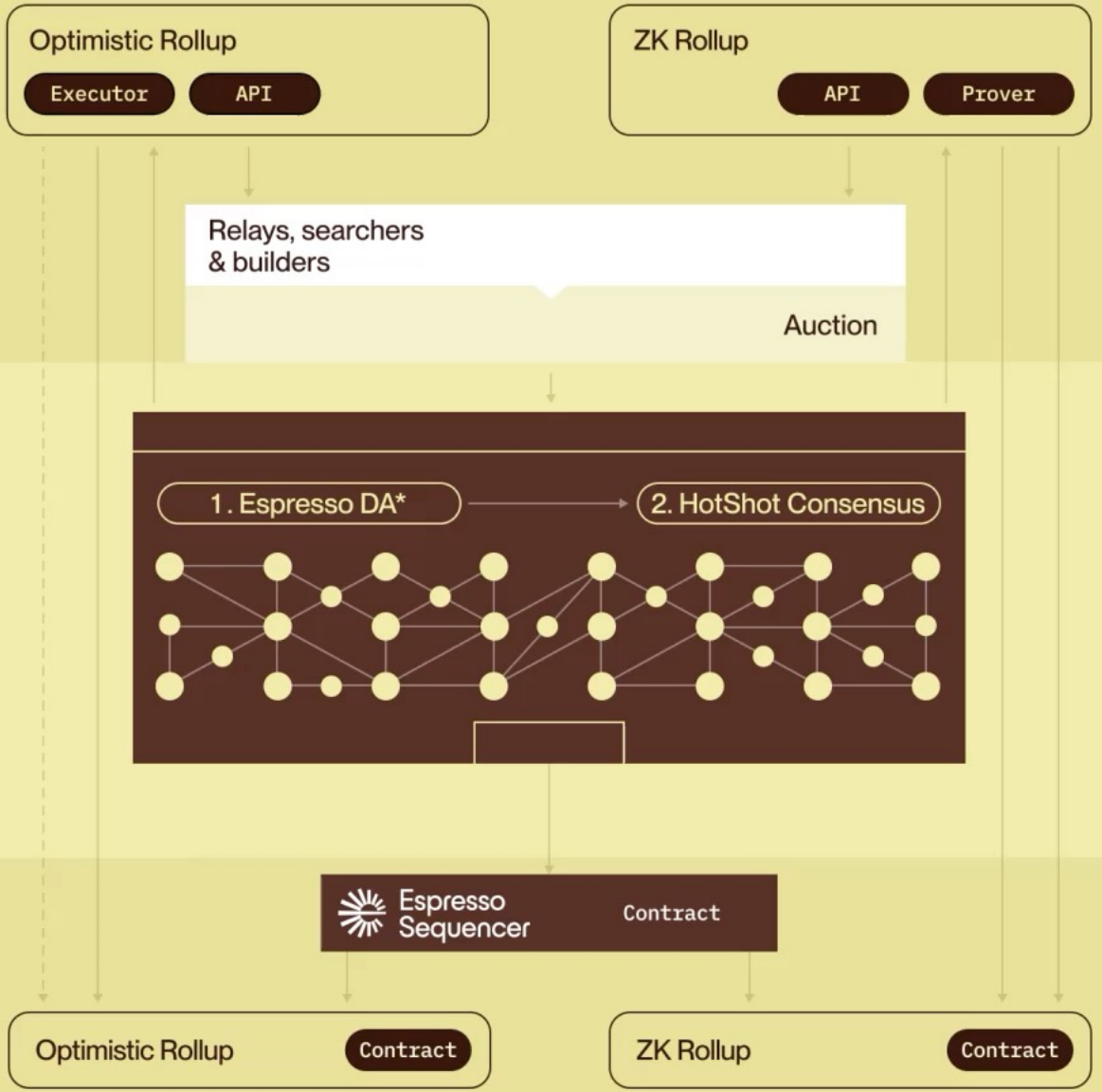
Scenario 2: Shared Sequencers

- Win PBS auction once
- Builder gives economically-bonding promise of atomic inclusion

Image credit: https://www.blocknative.com/blog/fundamentals-of-cross-chain-mev

End user clients

L2



Espresso Sequencer

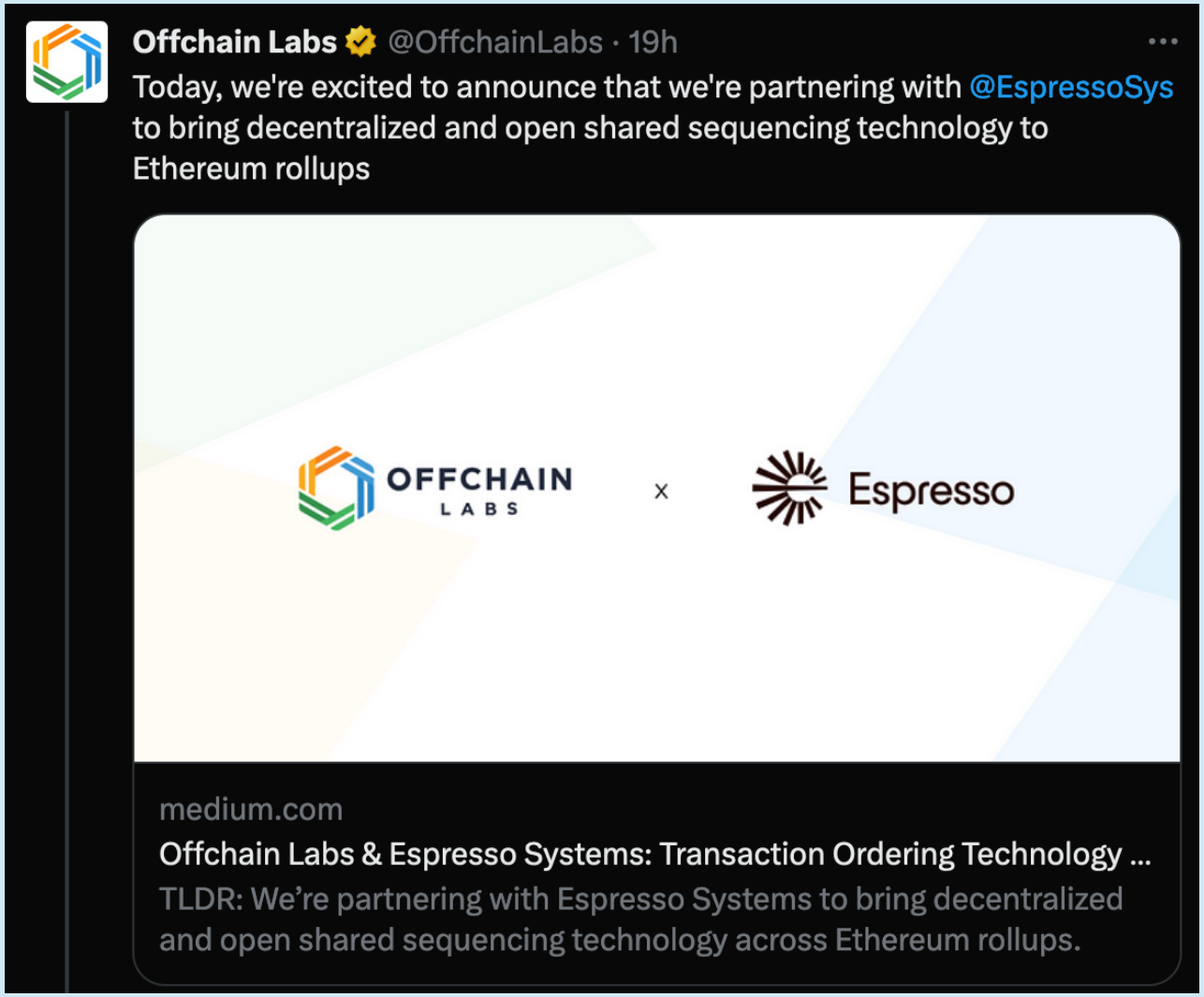
*Rollups may aditionally use Ethereum for data availability.

L1

Demo: Optimism + Cortado testnet!

Github: https://github.com/EspressoSystems/op-espresso-integration

Partnership: Offchain Labs & Espresso



Espresso Systems

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