

Simulation analysis

`leios-2025w27`
(including bug fix from `leios-2025w28`)

Experiments

- 1000 tx/s
- 300 B/tx
- 2.5 EB/stage
- 5 slot/stage
- two variants
 - full-with-ib-references
<https://github.com/input-output-hk/ouroboros-leios/blob/main/analysis/sims/2025w27/analysis.ipynb>
 - full-without-ibs
<https://github.com/input-output-hk/ouroboros-leios/blob/main/analysis/sims/2025w28/analysis.ipynb>

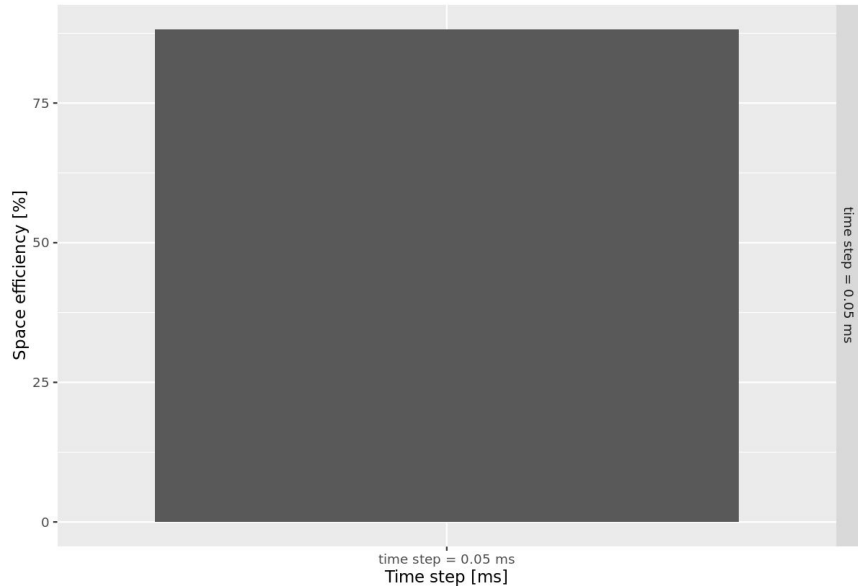
Summary results

Variant	Spatial Efficiency	Time to IB	Time to EB	Time to RB
full-with-ib-references	88.21%	66.008s	79.717s	106.110s
full-without-ibs	73.80%	-	3.317s	53.831s

Spatial efficiency

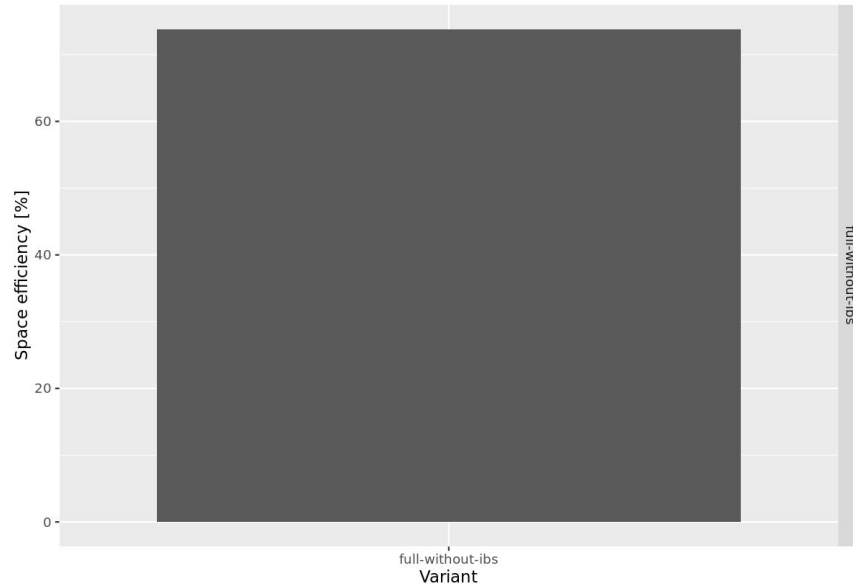
Spatial efficiency (size of txs on ledger / size of non-tx persisted data)

Rust simulator, mini-mainnet, full-with-tx-references, sharded, 1000 tx/s, 300 B/tx, 2 IB/s, 8 slot/st



Spatial efficiency (size of txs on ledger / size of non-tx persisted data)

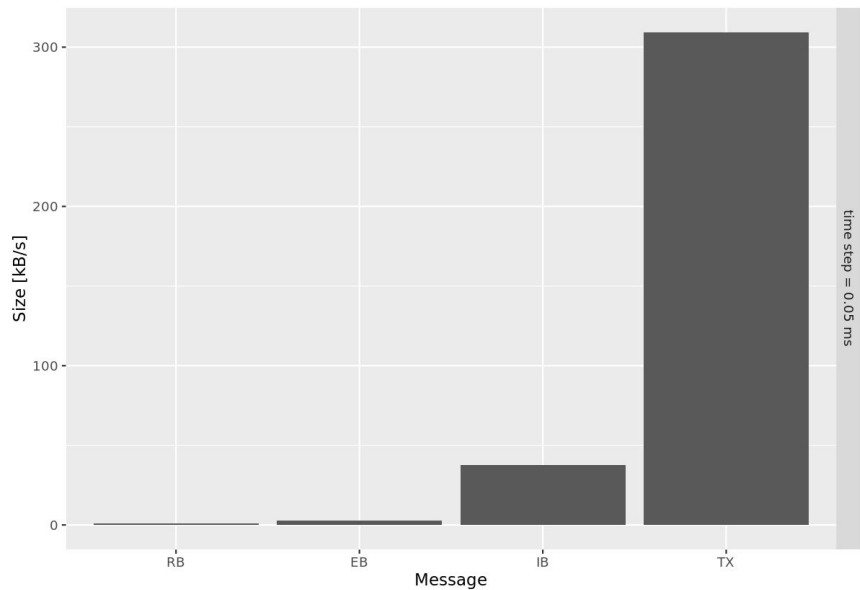
Rust simulator, mini-mainnet, full-without-ibs, 300 B/tx, 1000 tx/s, 5 slot/stage, 2.5 EB/stage



Disk storage

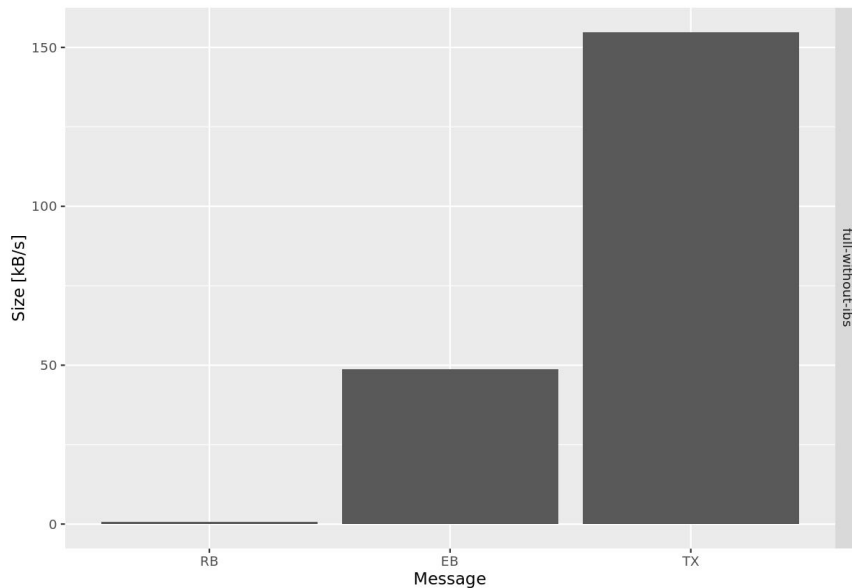
Size of persisted data

Rust simulator, mini-mainnet, full-with-tx-references, sharded, 1000 tx/s, 300 B/tx, 2 IB/s, 8 slot/s



Size of persisted data

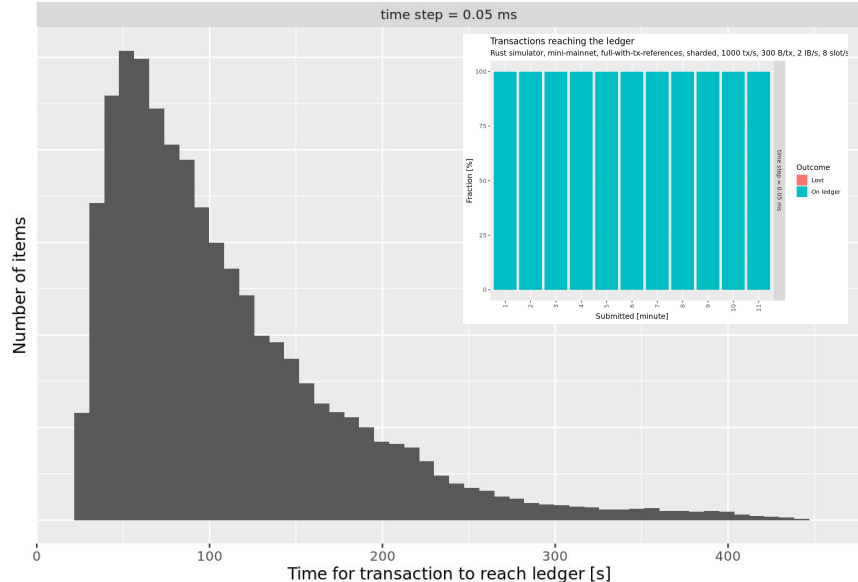
Rust simulator, mini-mainnet, full-without-ibs, 300 B/tx, 1000 tx/s, 5 slot/stage, 2.5 EB/stage



Temporal efficiency

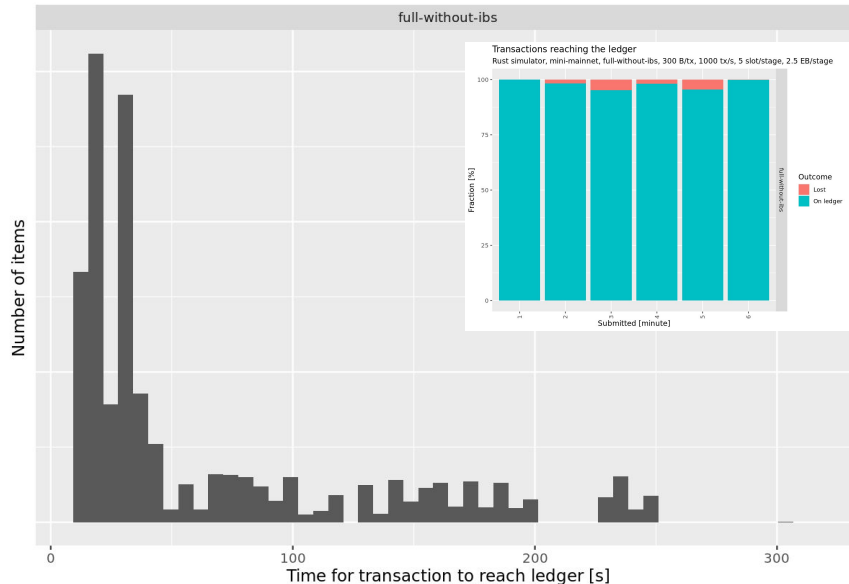
Time for transaction to reach the ledger

Rust simulator, mini-mainnet, full-with-tx-references, sharded, 1000 tx/s, 300 B/tx, 2 IB/s, 8 slot/stag



Time for transaction to reach the ledger

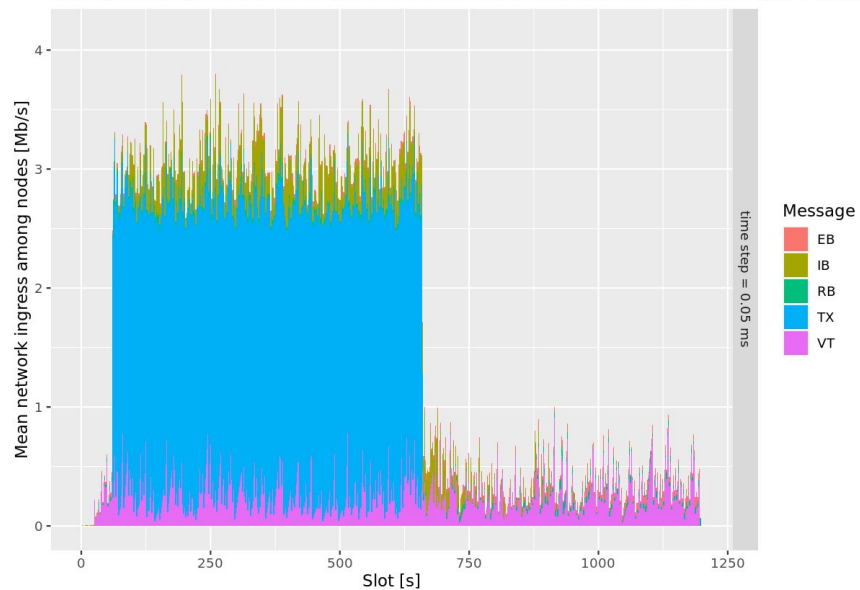
Rust simulator, mini-mainnet, full-without-ibs, 300 B/tx, 1000 tx/s, 5 slot/stage, 2.5 EB/stage



Network ingress

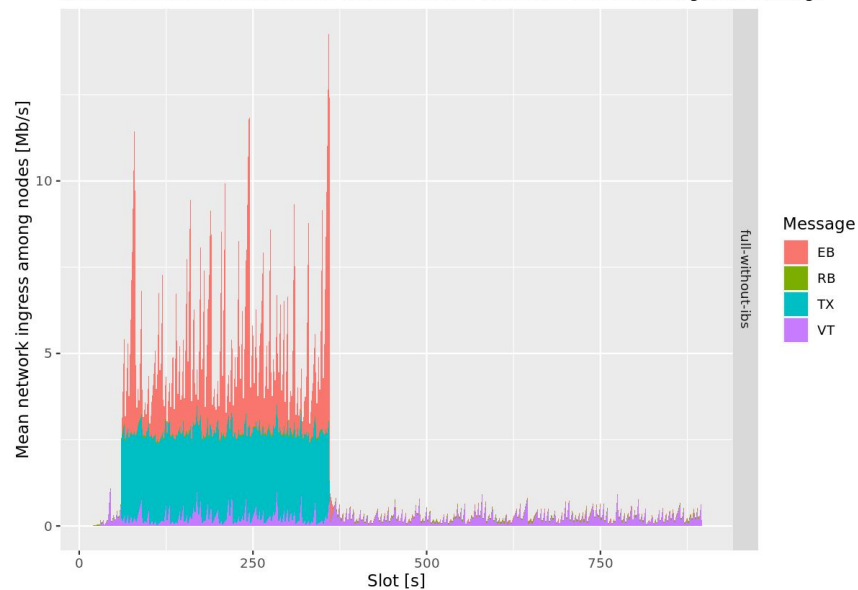
Mean nodal ingress

Rust simulator, mini-mainnet, full-with-tx-references, sharded, 1000 tx/s, 300 B/tx, 2 IB/s, 8 slot/stage



Mean nodal ingress

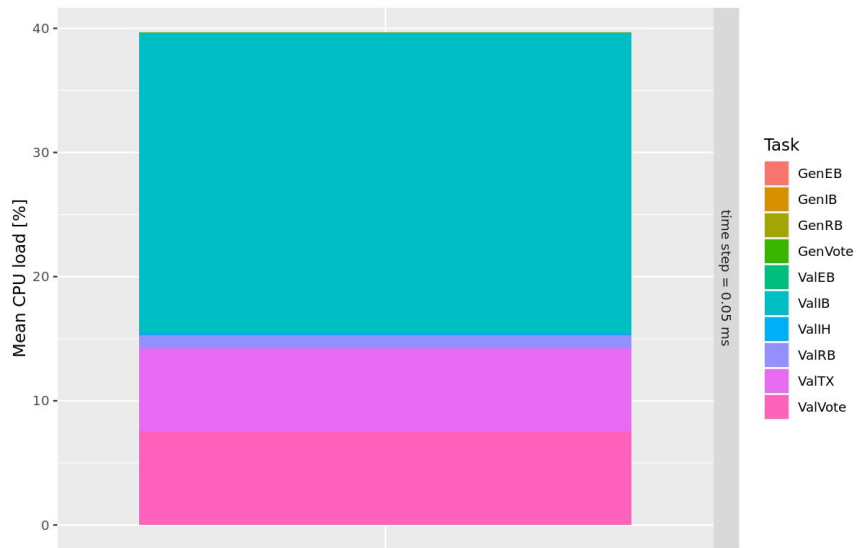
Rust simulator, mini-mainnet, full-without-ibs, 300 B/tx, 1000 tx/s, 5 slot/stage, 2.5 EB/stage



Mean CPU

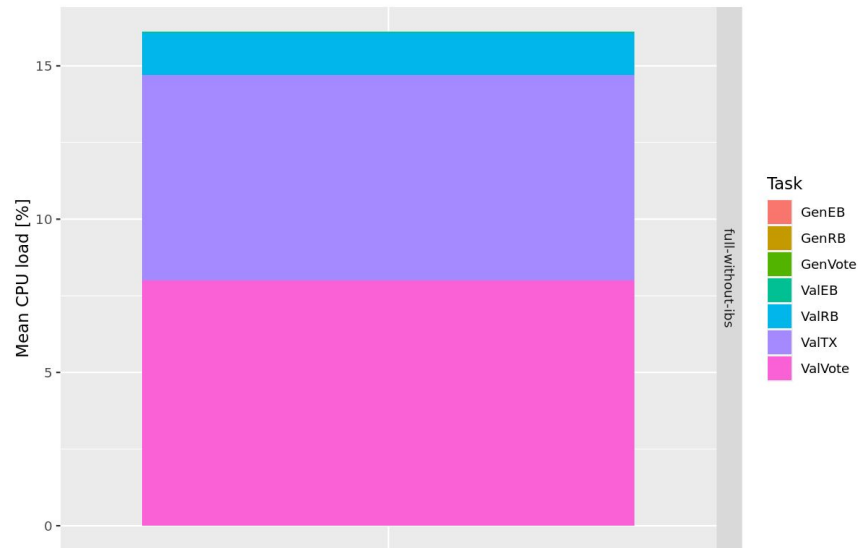
Mean CPU load among all nodes

Rust simulator, mini-mainnet, full-with-tx-references, sharded, 1000 tx/s, 2 IB/s, 8 slot/stage, 262 |

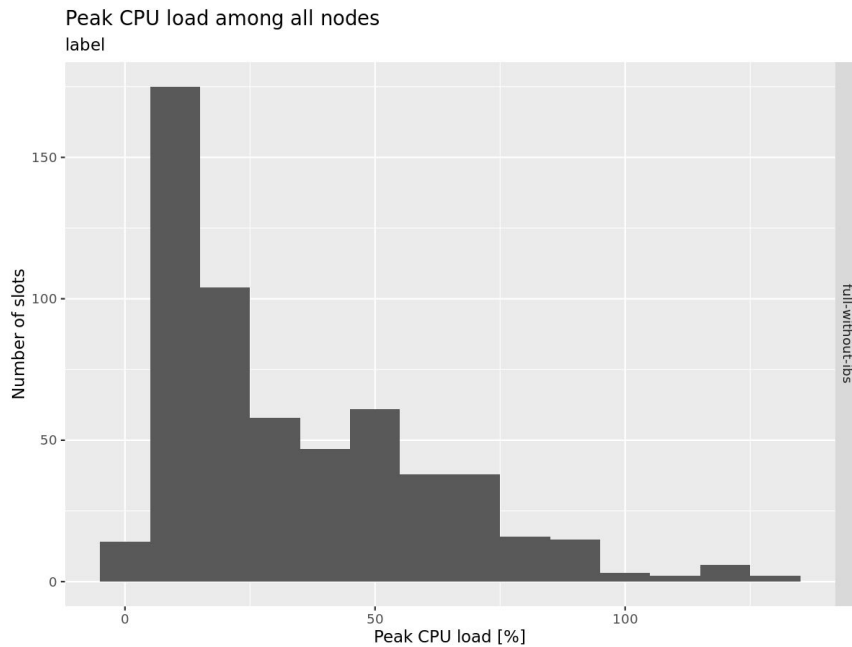
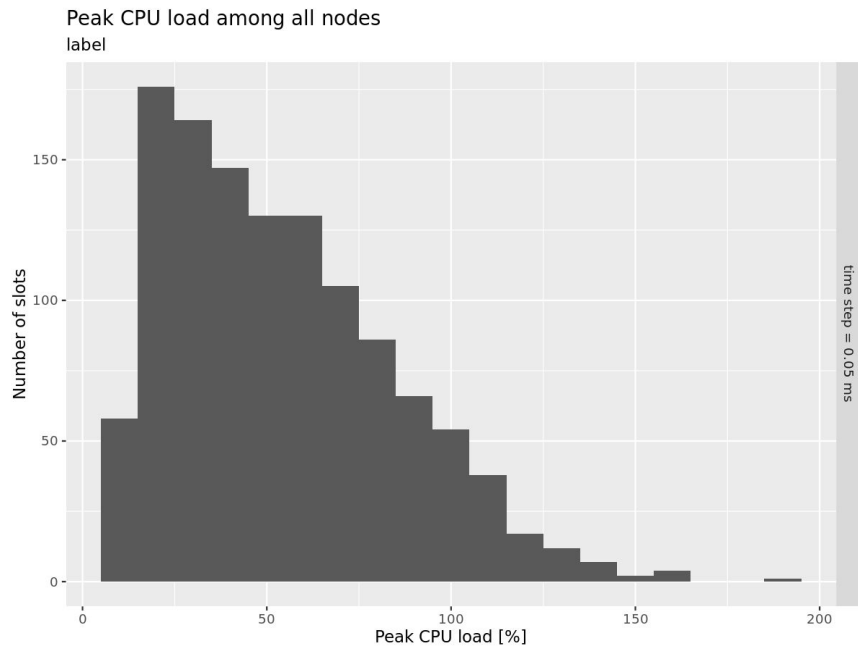


Mean CPU load among all nodes

Rust simulator, mini-mainnet, full-without-ibs, 300 B/tx, 1000 tx/s, 5 slot/stage, 2.5 EB/stage



Peak CPU



Findings

- 1000 tx/s with 300 B/tx is feasible in Leios variants
- Time vs space tradeoff
 - `full-with-ib-references` uses space more efficiently than `full-without-ibs`
 - `full-without-ibs` has shorter transaction lifecycle than `full-with-ib-references`
- `full-without-ib` loses some transactions, likely due to the aggressive pruning of the memory pool
- 2 CPU cores are sufficient
- Network usage is modest