

Analytical and Empirical Evaluation of the Feasibility of MEV Extraction Techniques on the Algorand Blockchain

Parshant Singh, Nov 06, 2023, Final Presentation Guided Research

Chair of Software Engineering for Business Information Systems (sebis)

Department of Computer Science

School of Computation, Information and Technology (CIT)

Technical University of Munich (TUM)

www.matthes.in.tum.de

1. Motivation and Background Information
2. Methodology
3. Results
4. Conclusion

Research Questions:

1. How can a local network topology be developed in algorand blockchain ?
2. Is it possible to prioritise my own transactions compared to others in the same smart contract i am interacting with ?
3. What network parameters matter for transaction prioritisation in FCFS blockchain ?

1. Motivation and Background Information
2. Methodology
3. Results
4. Conclusion

Types of Algorand Nodes

Participation Nodes

- ❑ Participates in the PPoS consensus
- ❑ Holds ALGO stake (min 0.1 ALGO)

Non-Participation Nodes

- ❑ Generally used to submit transactions to the blockchain
- ❑ Used to access the current state

Relay Nodes

- ❑ Responsible for propagating transactions, blocks, and consensus messages
- ❑ Also act as archival nodes

We did not use testnet for our experiments because of following reasons:

1. Dependency on a third-party node like PureStake.
2. The geographical locations of the PureStake nodes remain unknown.
3. Lack of transparency over the connections between nodes and relays.



Hence, we decided to leverage the testbed at the Network chair and deployed our own local network by utilising the EnGINE [1] framework for our experiments.

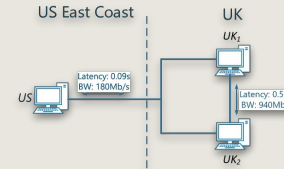
[1] F. Rezabek, M. Bosk, T. Paul, K. Holzinger, S. Gallenmuller, A. Gonzalez, A. Kane, F. Fons, Z. Haigang, G. Carle, et al., Engine: Flexible research infrastructure for reliable and scalable time sensitive networks, Journal of Network and Systems Management 30 (4) (2022)

Setup

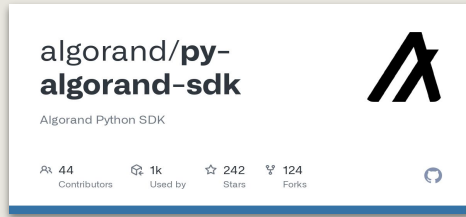
Deployed Local Network on Testbed



Network param configuration (latencies, account creation, etc)



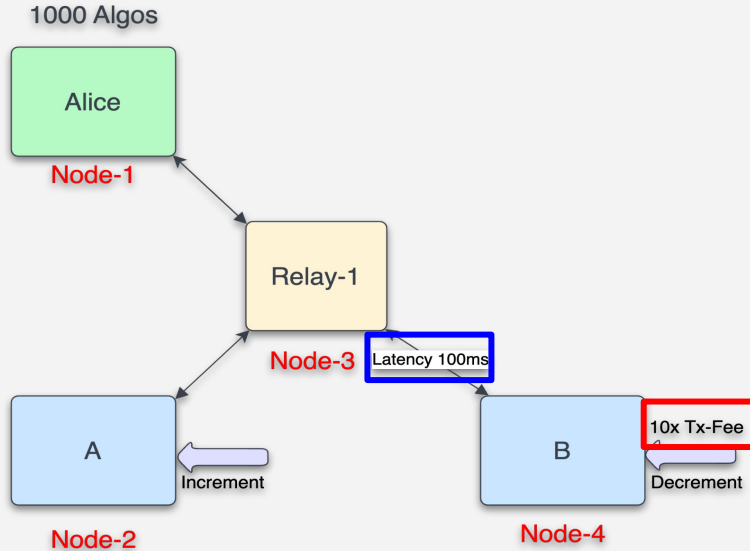
Python SDK for smart contract interaction



Deployment of Smart contract

Algorithm 1 Smart Contract Operations

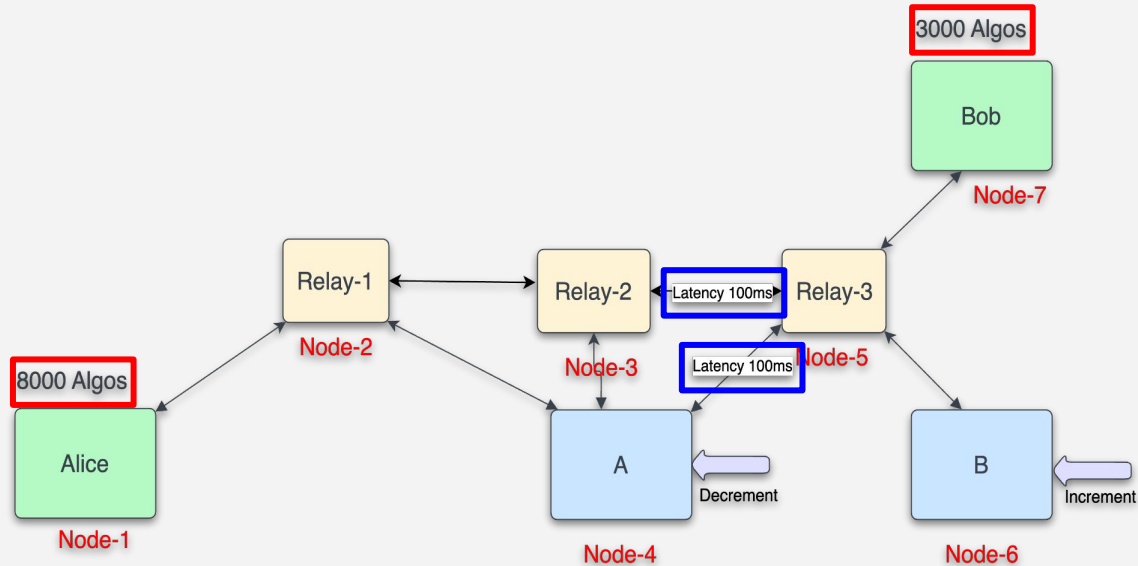
- 1: **Initialize** global variable $last_executed = ""$
- 2: **function** INCREMENT
- 3: $last_executed \leftarrow "increment"$
- 4: **function** DECREMENT
- 5: $last_executed \leftarrow "decrement"$



Scenario-1

Goals

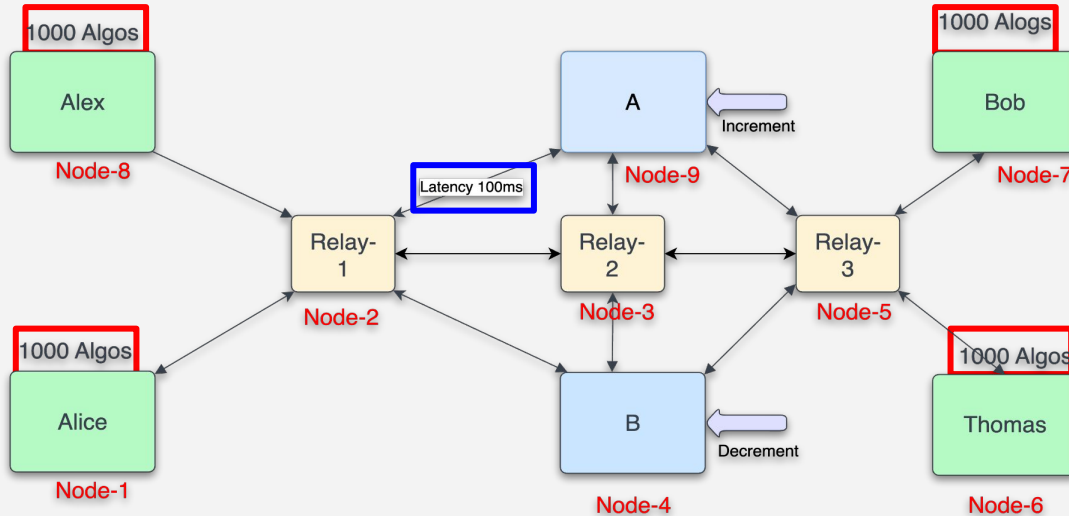
- ❑ Verify that Algorand blockchain is FCFS Blockchain
- ❑ Attaching extra gas fee to the transaction does not have any impact on its ordering.



Scenario-2

Goals

- ❑ Verify validator selection is proportional to the stake of the node.
- ❑ Proximity to the validator has higher impact than better network connectivity for getting transaction prioritised.

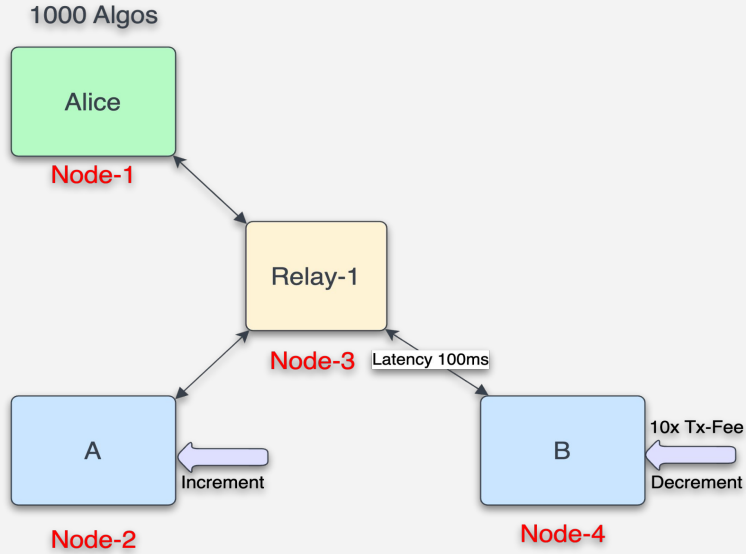


Scenario-3

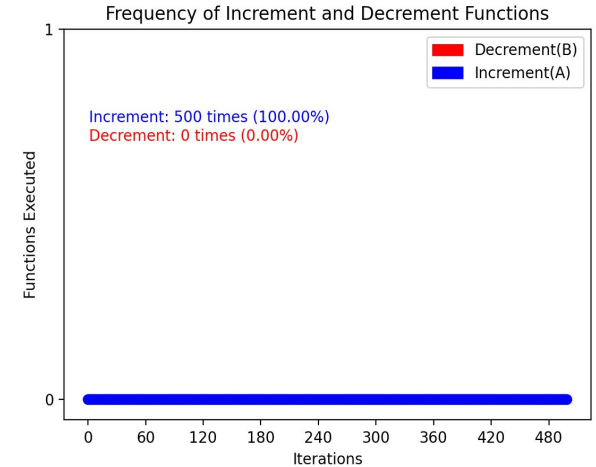
Goals

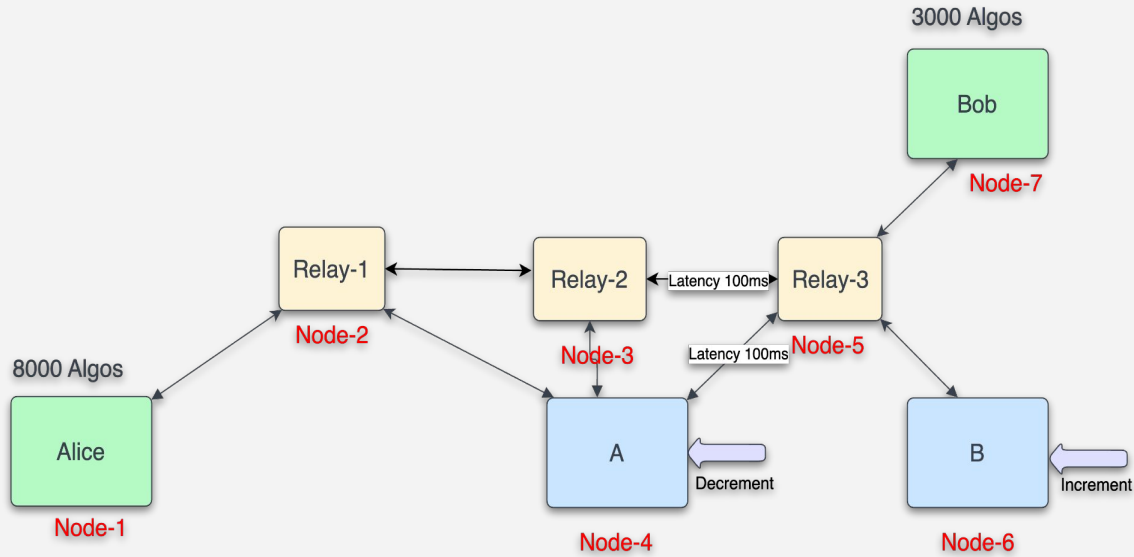
- ❑ Validator proximity has a greater impact on transaction priority than network connectivity.
- ❑ If two transaction nodes are equidistant from the validator, both have an equal chance of prioritization.

1. Motivation and Background Information
2. Methodology
3. Results
4. Conclusion

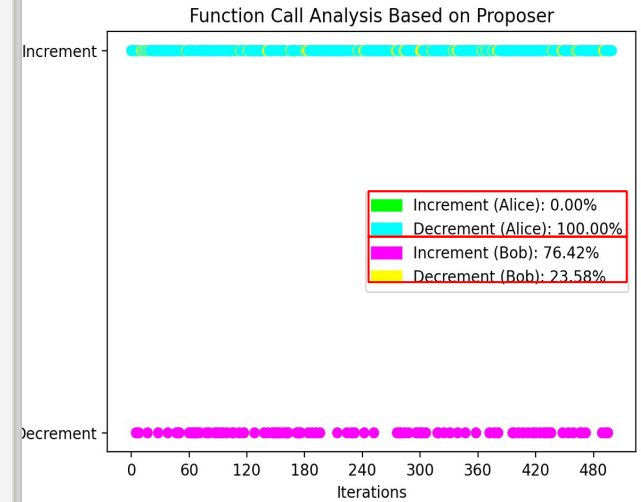


Scenario-1

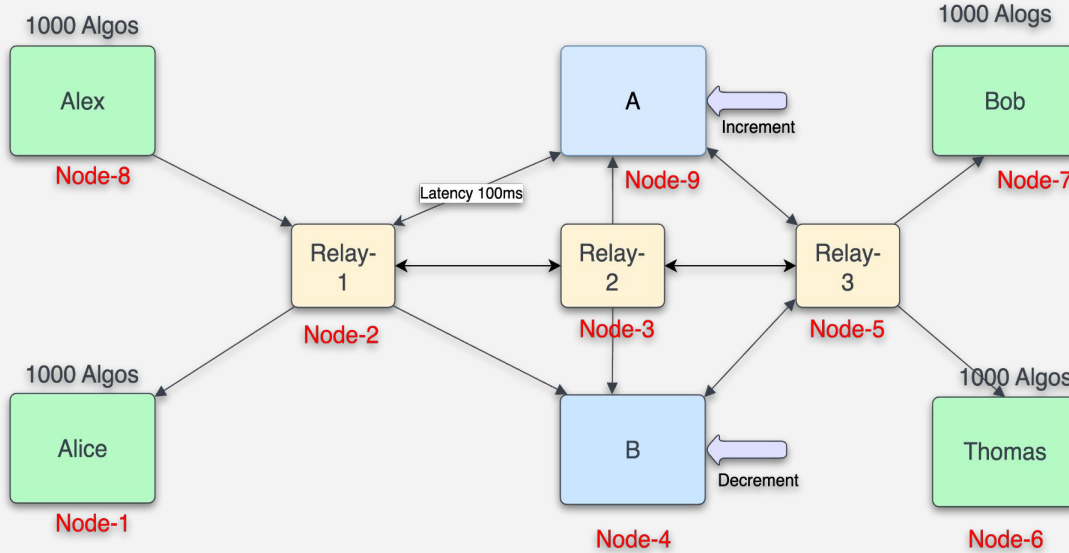




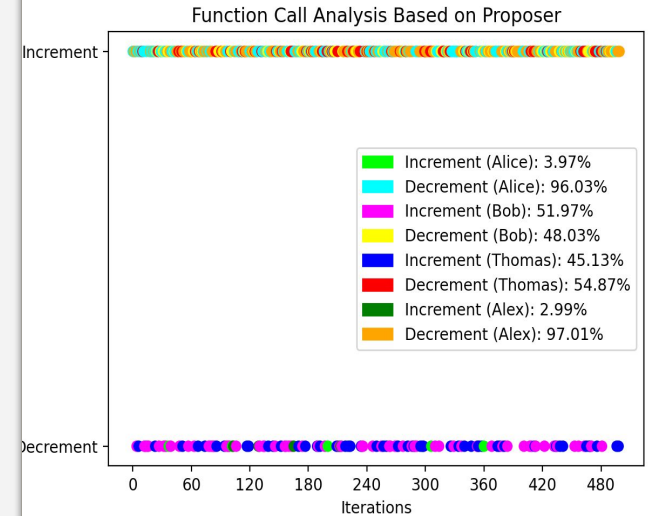
Scenario-2



Alice was validator **377/500** iterations
Bob was the validator **123/500** iterations



Scenario-3



Alice was the validator **126/500** iterations
Bob was the validator **134/500** iterations
Thomas was the validator **127/500** iterations
Alex was the validator **113/500** iterations

1. Motivation and Background Information
2. Methodology
3. Results
4. Conclusion

1. FCFS Nature of Algorand:

- Algorand operates primarily as a First-Come-First-Serve (FCFS) blockchain
- Adding higher fees to transactions doesn't expedite their processing

2. Proximity Plays a Key Role:

- The closeness of the transaction's originating node to the proposer node significantly influences its placement in a block

3. Implications for Searchers (entity who tries to execute an arb):

- This proximity-centric behavior is essential knowledge for those aiming to optimize transaction value in Algorand
- Arbitrage searchers and similar entities should tailor their strategies accordingly for transaction prioritization

1. **RQ1:** How can a local network topology be developed in algorand blockchain ?
 - We leveraged EnGine to deploy a local algorand blockchain
 - Can be extended to more complex topologies
2. **RQ2:** Is it possible to prioritise my own transactions compared to others in the same smart contract i am interacting with ?
 - Connecting to relays which are connected to higher stake participating nodes
3. **RQ3:** What network parameters matter for transaction prioritisation in FCFS blockchain ?
 - Latencies between Relays and Relays-Nodes matter
 - Running multiple nodes to have a better chance to get the transaction executed



Parshant Singh

parshant.singh@tum.de

Technical University of Munich (TUM)
TUM School of CIT
Department of Computer Science (CS)
Chair of Software Engineering for
Business Information Systems (sebis)

Boltzmannstraße 3
85748 Garching bei München

+49.89.289.

www.matthes.in.tum.de

