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

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Outline

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

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?
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Methodology

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.

**Methodology**

**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 = "increment"`
4. `function decrement`
5. `last_executed = "decrement"`
Goals

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

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-2
Methodology

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.
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Results

Scenario-1

1000 Algos

Alice

Node-1

Relay-1

Node-3

Latency 100ms

A

Increment

Node-2

B

10x Tx-Fee

Decrement

Node-4

Frequency of Increment and Decrement Functions

Increment: 500 times (100.00%)
Decrement: 0 times (0.00%)
Results

Scenario-2

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