Not Enough IoT After All: Visiting Transactional Characteristics of IoT Blockchains

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Overview

1. Introduction
2. Dataset Overview
3. IoT Blockchain Analysis
   - IoTeX
   - Helium
4. Conclusion
Blockchain Introduction

- Decentralized ledger for recording transactions
- Recorded as Block or chain of transactions (DAG)
- A transaction can initiate several actions
- Blocks/txns are mined or validated as per Consensus rules
Blockchain Introduction

- Block production time (epoch) depends on consensus protocol
- Epochs have varying definitions across different blockchains.
- Throughput/Utilization capability is defined as transactions per block
- Time per block is defined in IoTeX and Helium blockchains
IoT Blockchain

- IoT devices are resource constrained, lightweight
- Typically everything that blockchain operation requires, they don’t have enough of it
- Usually connected using edge computing, not directly connected to the network
Dataset Overview
Dataset Overview

- IoTeX - Blocks: 1 to 19,500,000
  Transactions: 29,412,868
  April 2019 till September 2022
- Helium - Blocks: 1 to 1,531,124
  Transactions: 498,291,572
  July 2019 to September 2022

## Dataset Overview

<table>
<thead>
<tr>
<th>Category</th>
<th>Action name</th>
<th>Count</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer-to-peer transactions</td>
<td>Transfer</td>
<td>1,718,711</td>
<td>6%</td>
</tr>
<tr>
<td>Smart Contract</td>
<td>Verified SCs</td>
<td>11,498,337</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>Unverified SCs</td>
<td>9,224,124</td>
<td>31%</td>
</tr>
<tr>
<td>Others transactions</td>
<td>Governance</td>
<td>6,971,696</td>
<td>24%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>29,412,868</td>
<td>100%</td>
</tr>
</tbody>
</table>
## Dataset Overview

<table>
<thead>
<tr>
<th>Category</th>
<th>Action name</th>
<th>Count</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proof of Coverage Challenge</td>
<td>PoC Request</td>
<td>292,828,528</td>
<td>59%</td>
</tr>
<tr>
<td>Proof of Receipts</td>
<td>Version 1</td>
<td>141,012,708</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>Version 2</td>
<td>39,419,556</td>
<td>8%</td>
</tr>
<tr>
<td>Validator</td>
<td>Heartbeat</td>
<td>18,498,289</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Stake Validator</td>
<td>4121</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transfer Stake</td>
<td>706</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unstake Validator</td>
<td>492</td>
<td></td>
</tr>
<tr>
<td>Assert Location</td>
<td>Version 1</td>
<td>65,971</td>
<td>0.4%</td>
</tr>
<tr>
<td></td>
<td>Version 2</td>
<td>2,202,359</td>
<td></td>
</tr>
<tr>
<td>Payment</td>
<td>Version 1</td>
<td>381,502</td>
<td>0.5%</td>
</tr>
<tr>
<td></td>
<td>Version 2</td>
<td>2,140,718</td>
<td></td>
</tr>
<tr>
<td>Hotspot</td>
<td>Add gateway</td>
<td>950,300</td>
<td>0.2%</td>
</tr>
<tr>
<td></td>
<td>Transfer Hotspot V1</td>
<td>82,616</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transfer Hotspot V2</td>
<td>94,434</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>rewards, state channels, etc.</td>
<td>609,272</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>498,291,572</td>
<td>100%</td>
</tr>
</tbody>
</table>
IoTeX Analysis
IoTeX Analysis

- Top 5 Smart Contracts: 62% traffic, no IoT DApp
- 95% Smart contract traffic comes from just 50 DApps
- Non-IoT apps are dominating the traffic
- Traffic and price correlated on several intervals
Low Transaction spam - IoTeX Analysis

- August 2021 Low-value P2P transaction spam
- 0xe3DF5d103551b1D3d8117c59223AB62f1Ad15552 sending 0.1 IOTX to random unique address, 14% of all P2P
- Recipients didn’t move even a single token
- Right before secondary market sale which is followed by a Seed investment round
IoTeX Analysis

- 24% on-chain governance transactions
- Block rewards related
- Not used in any application
Helium Analysis
Helium Analysis

- Network congestion with PoC request
- Useful IoT traffic accounts for less 0.1%
- Usual network outages due to protocol congestion
- P2P txns have 0.5% share
Helium Analysis

- Vast difference between PoC request and PoC receipt
- 150 Millions stale PoC requests
- Protocol inefficiencies lead to resource wastage
Conclusion

- IoTeX and Helium traffic suggest non-IoT adoption
- Both are highly inefficient due to protocol design issues, not fit for on IoT device client
- Helium is tending towards modular decompose of protocol (long awaited)
- IoTeX published half of the blocks empty, EVM clone with lower transaction fee