Blockchain Enabled IoT Edge Computing

Pankaj Mendki
Talentica Software
Presentation for ONS Europe 2019
Blockchain Overview

Centralized Authority holding ledger

Everyone holding a copy of ledger
Blockchain Overview

- Transaction Data
- Nonce
- Previous Block Hash

...
Blockchain Overview

- Transaction Data
- Nonce
- Previous Block Hash
...
Blockchain Overview

- Transaction Data
- Nonce
- Previous Block Hash

Proposed Block
Blockchain Advantages

• Immutable

• Transparent

• Trustless
Blockchain Applications

Where is my nail?
Blockchain Decision Tree

- Multiple Parties Involved
  - YES
  - Multiple Parties Interact
    - YES
    - Trusted Authority
      - NO
      - Use Blockchain
IoT Pipeline

Data Collection → Data Transmission → Data Aggregation → Data Distribution → Data Consumption

Source: https://exosite.com/iot-platform/
Edge Computing

- High data volume
- Need for speed
- Data security
Industrial IoT Use case

Source: https://exosite.com/iot-platform/

Edge Computing
CCTV Camera Use case

- 500,000 CCTVs in London
- Number of CCTVs is increasing
CCTV Camera Use case

Source: https://medium.com/nanonets/how-to-automate-surveillance-easily-with-deep-learning-4eb4fa0cd68d
Compute Resource Requirements

- Compute intensive analytics require edge server

- Scaling edge server
  - Improved AI/ML model
  - Increasing data volume
Compute Resource Requirements

- Why rely on single edge server?
- Can we outsource / Crowd-source computing?
The typical American household contains multiple connected devices

% of U.S. adults who say their household contains a ...

<table>
<thead>
<tr>
<th>Device</th>
<th>Median number per household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartphone</td>
<td>2</td>
</tr>
<tr>
<td>Desktop or laptop computer</td>
<td>1</td>
</tr>
<tr>
<td>Tablet</td>
<td>1</td>
</tr>
<tr>
<td>Streaming media device</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Any of these</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: Streaming media device refer to devices such as an Apple TV, Roku, Google Chromecast or Amazon Fire TV.
Source: Survey conducted Sept. 29-Nov. 6, 2016.
PEW RESEARCH CENTER

Blockchain Decision Tree

- Multiple Parties Involved
  - YES
  - Multiple Parties Interact
    - YES
    - Trusted Authority
      - NO
      - Use Blockchain
Solution Components

• Requester – Creates a job
• Resource lender
• Worker node
• Blockchain network
Processing Flow

1. Requester
2. Gateway
3. Blockchain
4. Resource lenders

Worker nodes
Challenges

- Verification of computation
  - Process logs
  - Implant test data in Job
  - Redundancy

- Reward system
  - Token system

- Packaging and Distribution of job processing environment
  - Containers
Conclusion

- Edge computing is evolving as complementary architecture to cloud processing
- Blockchain can help building crowd sourced infra for edge computing
Q&A