

Visualization + Analysis

Blockchains Are

- Networks
- Time-series

Visualization

- Quickly spot properties
- Quickly spot inconsistencies
- Ask better questions

This Lecture

- Analyze some properties of cryptocurrencies
- Tools
- Data Sources
- Insights
- Sample code

Distributions

Distributions

- Distributions of:
 - Transaction Fees
 - Wallet net worths
 - Bitcoin Script Usage
 - Whales

Bitcoin Transaction Fees

- BTC
 - Satoshi per byte
 - 100mn Satoshis = 1 BTC

Ethereum Transaction Fees

- ETH
 - Gas
 - 21000 Gas = Base fee
 - Just transferring funds
 - Put down Gas Price
 - Pay Gas Price * Gas Used
 - Put down Gas limit

Bitcoin Transaction Fees

Fee	Txns
0	8380
1	9407071
2	2841101
...

Why Zeros?

- Possibly:
 - Miners' own transactions
 - Incredible generosity
 - Off-chain payment

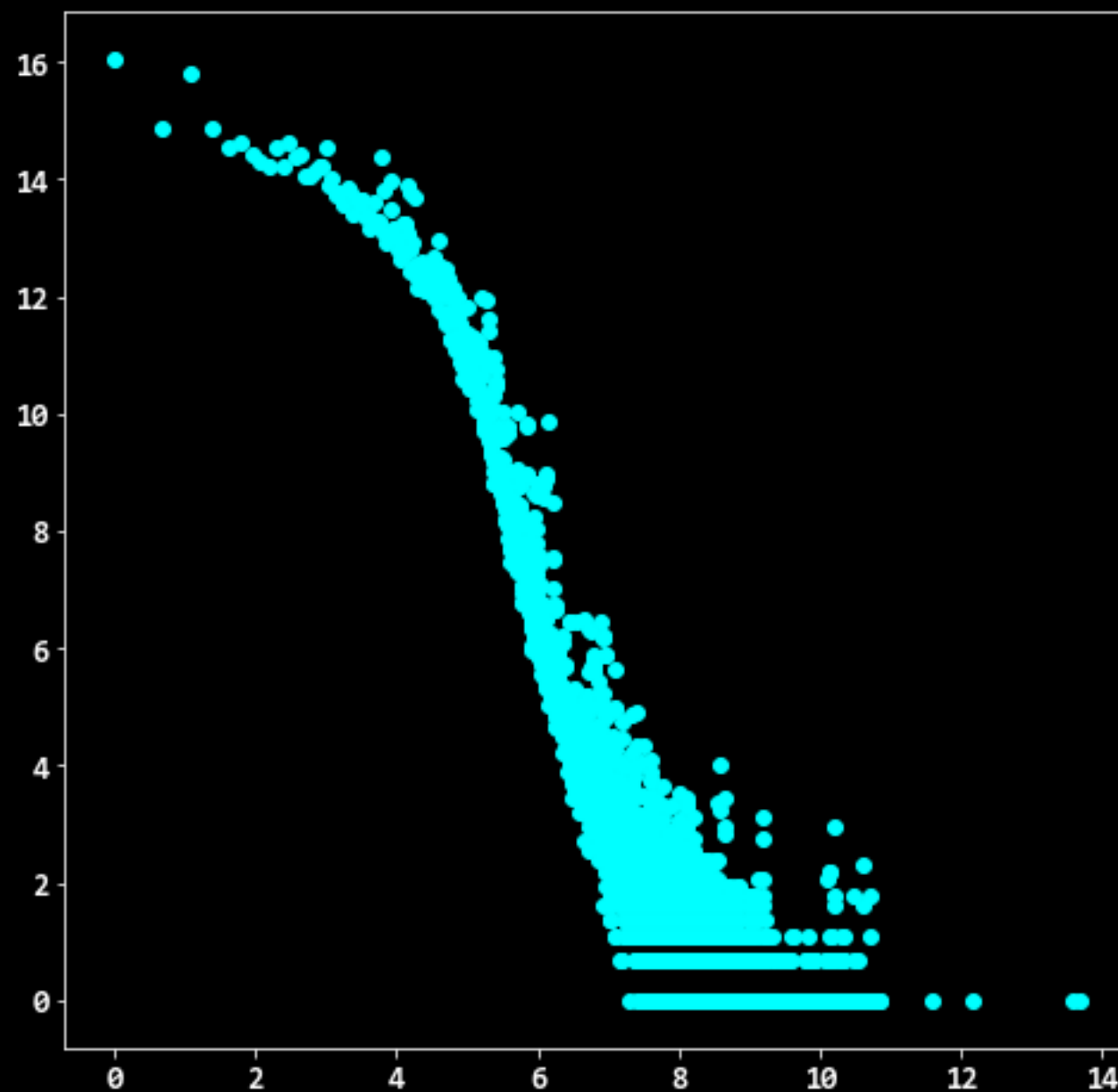
Most Common Fee

Fee	Txns
1	9407071
3	7448408
4	2863087
...

Distribution

- Raw bar chart bad for viz (large variance).
- Solution:
 - log/log plot

Log-Log Plot



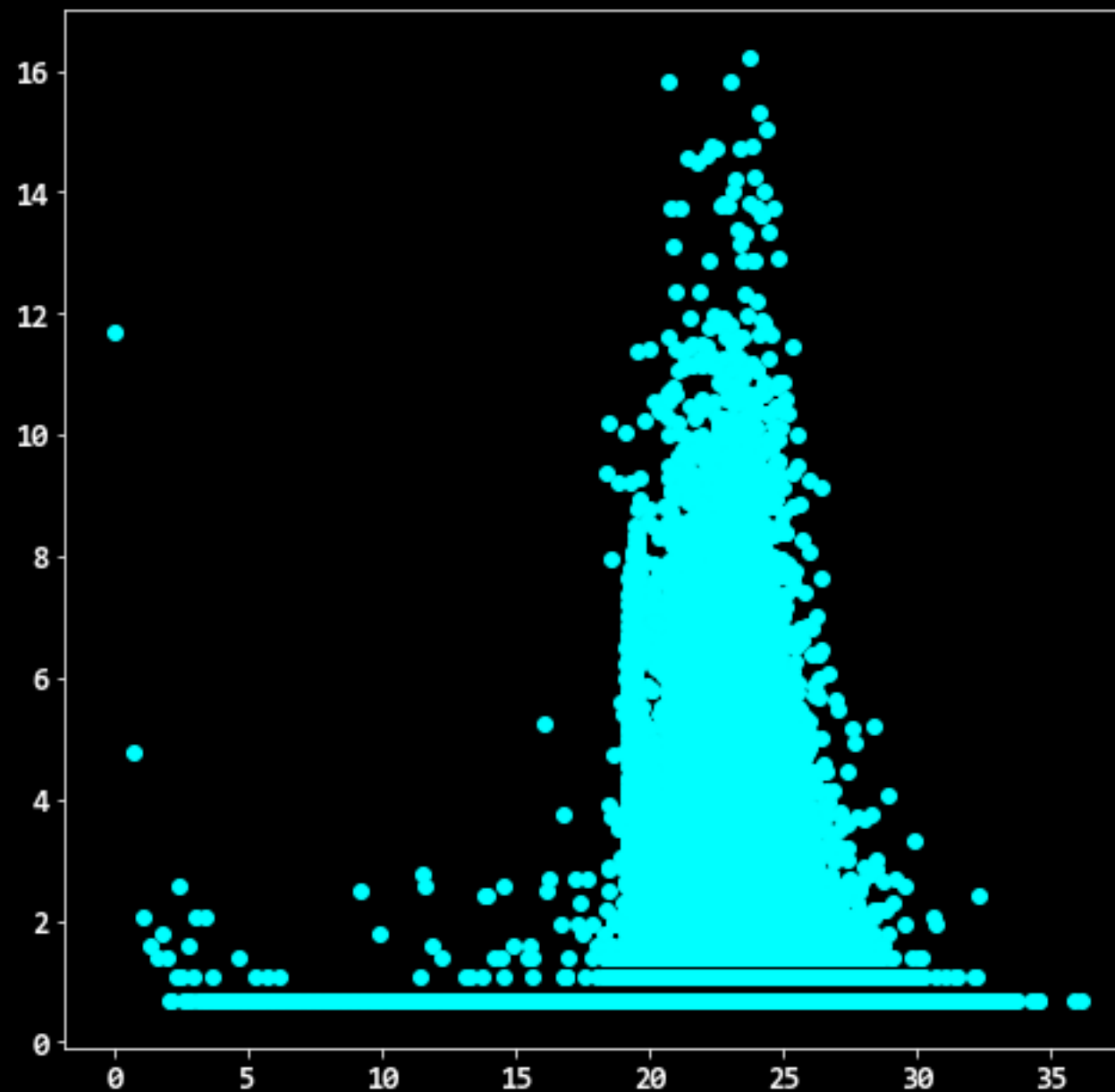
Log-Log Plot

- Seems like a truncated power law

Power Laws

- 80/20 Rule
- Internet Networks
- Traffic Arrival Times
- Zipf
- Twitter followers

Ethereum Gas Prices



log-normal?

Ethereum Gas Prices

Fee	Txns
0	121023
1	117
2	7
...

Most Common Fee

Fee	Txns
200000000000	11107198
100000000000	7354494
100000000000	7339890
...

Zero Gas Prices?

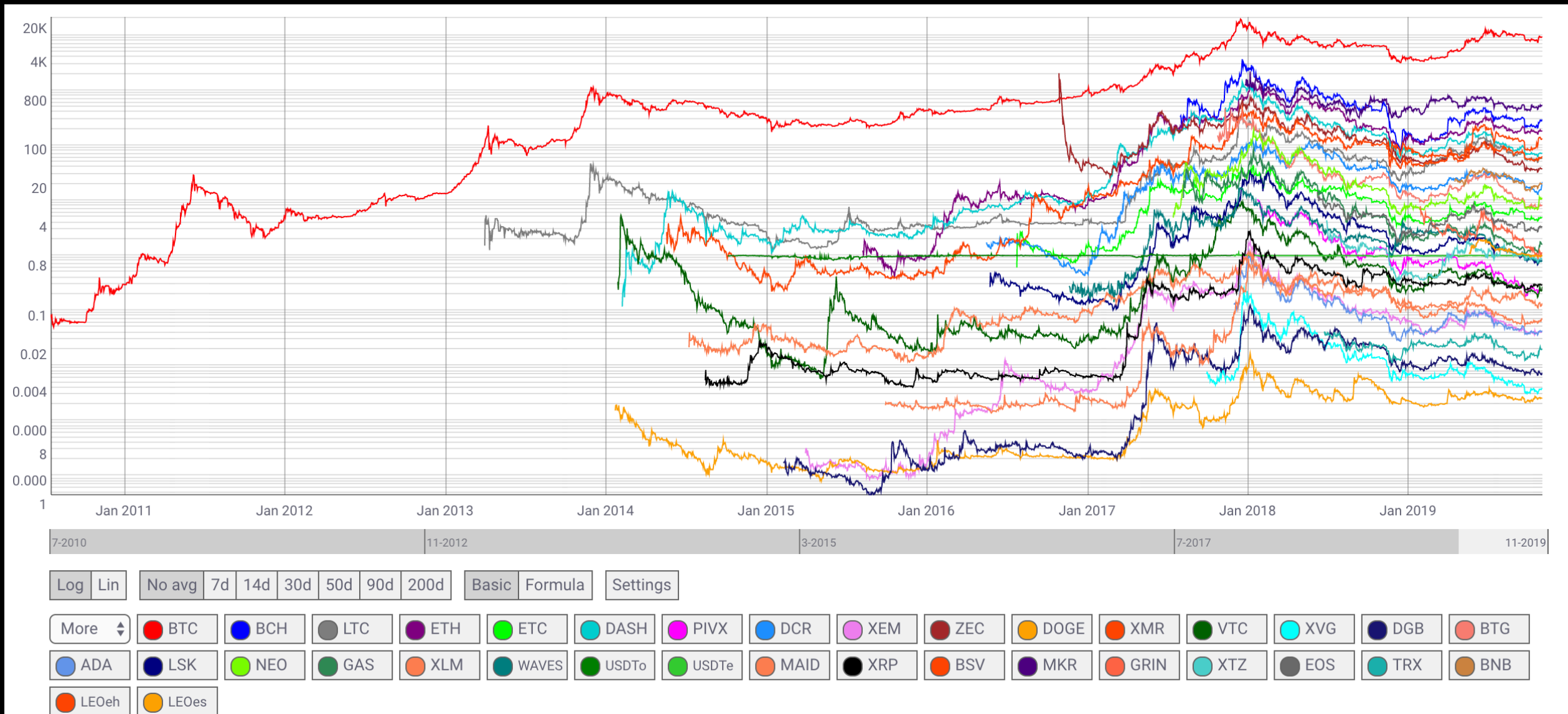
- https://www.reddit.com/r/ethereum/comments/7lx1do/a_christmas_mystery_sweepers_and_zero_gas_price/
- <https://medium.com/chainsecurity/zero-gas-price-transactions-what-they-do-who-creates-them-and-why-they-might-impact-scalability-aeb6487b8bb0>

Time-Series

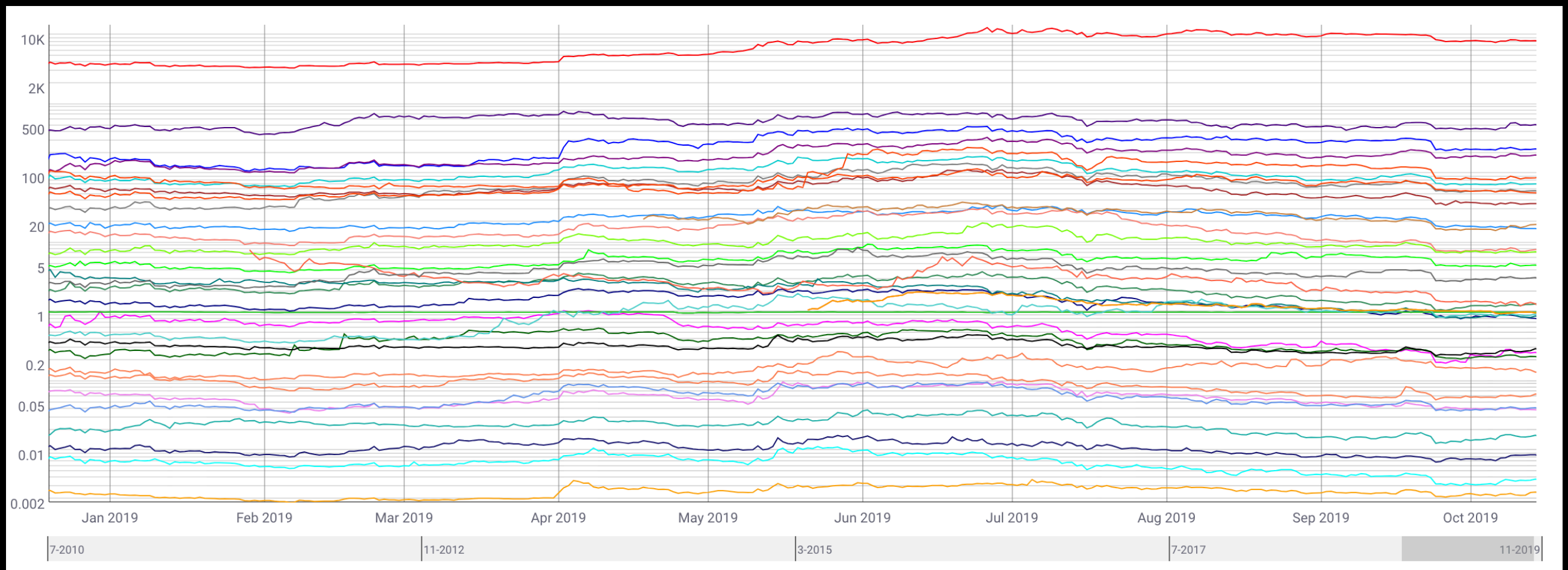
Correlate With Events

- Correlation to fiat?
- Correlation to other coins?

Other Coins



YTD



Spearman's Rank Correlation

Col1	Col2

Spearman's Rank Correlation

Col1	Col2
Rank=2	Rank=3
Rank=10	Rank=5
Rank=5	Rank=2
Rank=3	Rank=1

Spearman's Rank Correlation

- Row-wise difference squared : d^2
- Sum up these row-wise differences
- $$R_s = 1 - \left(\frac{6 \sum d^2}{n^3 - n} \right)$$

Spearman's Rank Correlation

- $+1/-1$: Strong positive / Strong negative
- 0 : No correlation

Correlation Charts – Coins



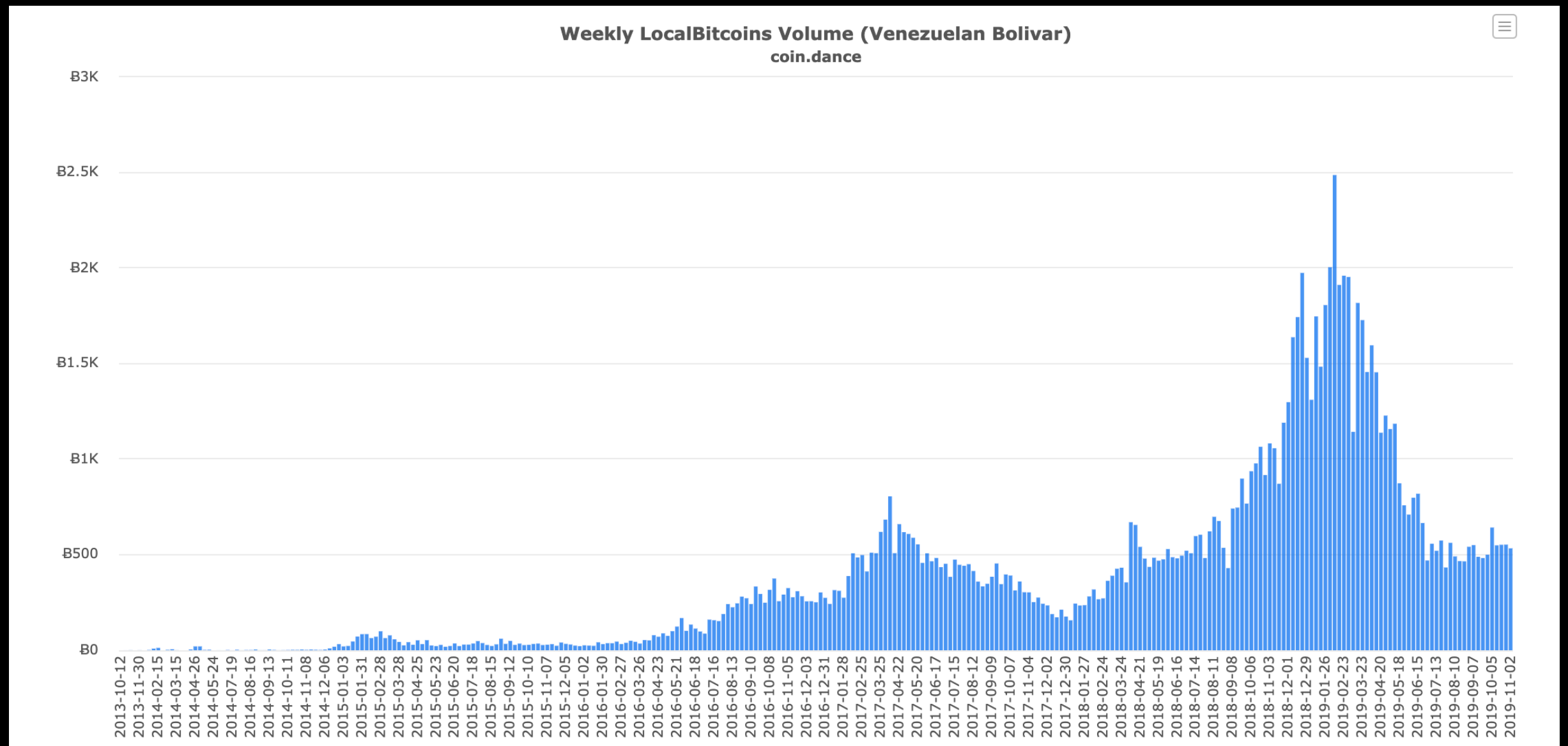
Correlation Charts – BTC v. Fiat



So?

- Looks like there is almost no correlation to fiat
- Coins almost all move in lock-step
- Implications?

BTC Volume Events



Network

Visualizing Networks

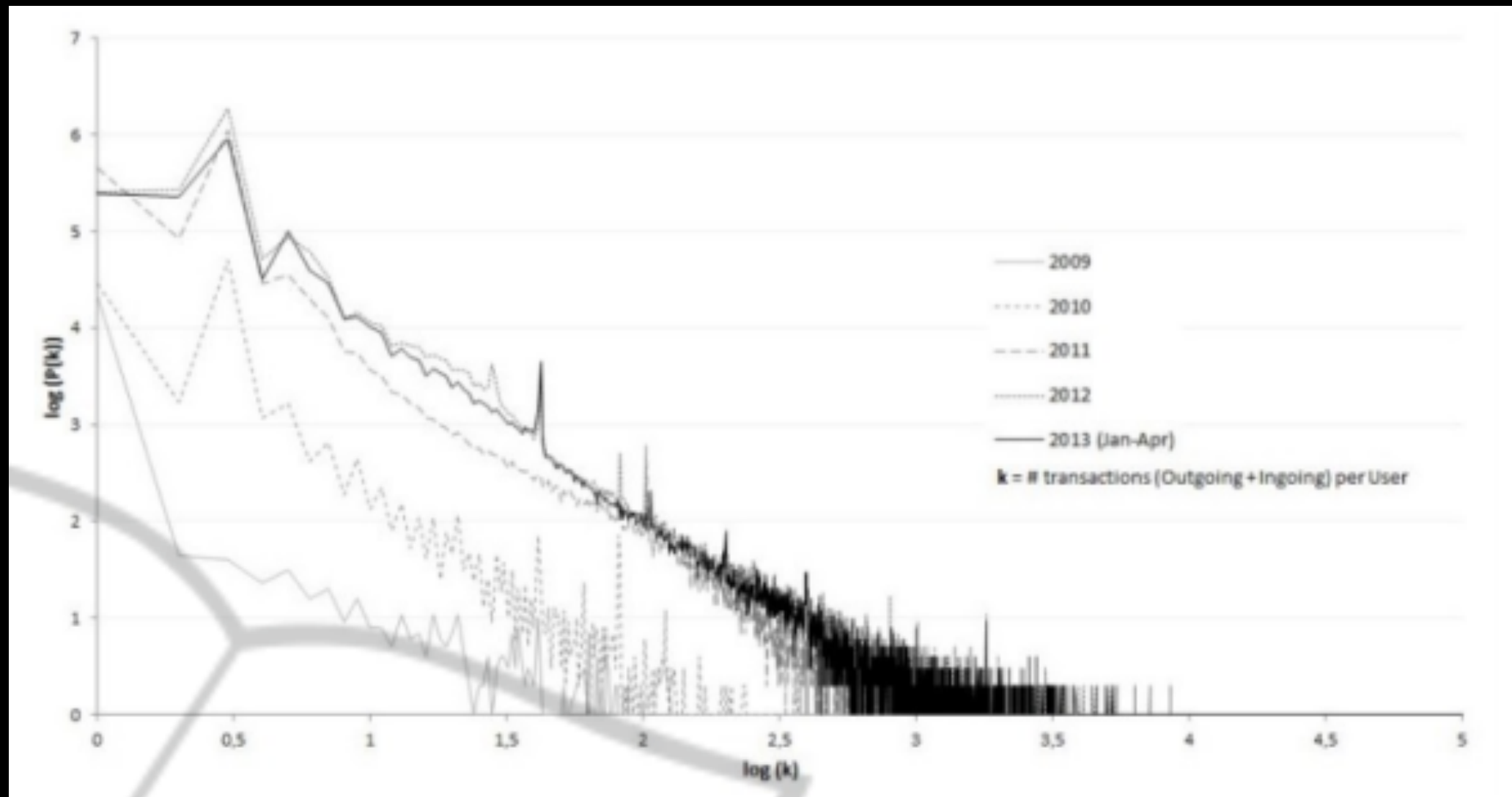
- Slightly complex with bitcoin
- The Bitcoin graph:
 - Nodes: wallet addresses
 - Edges: Spends

Visualizing Networks

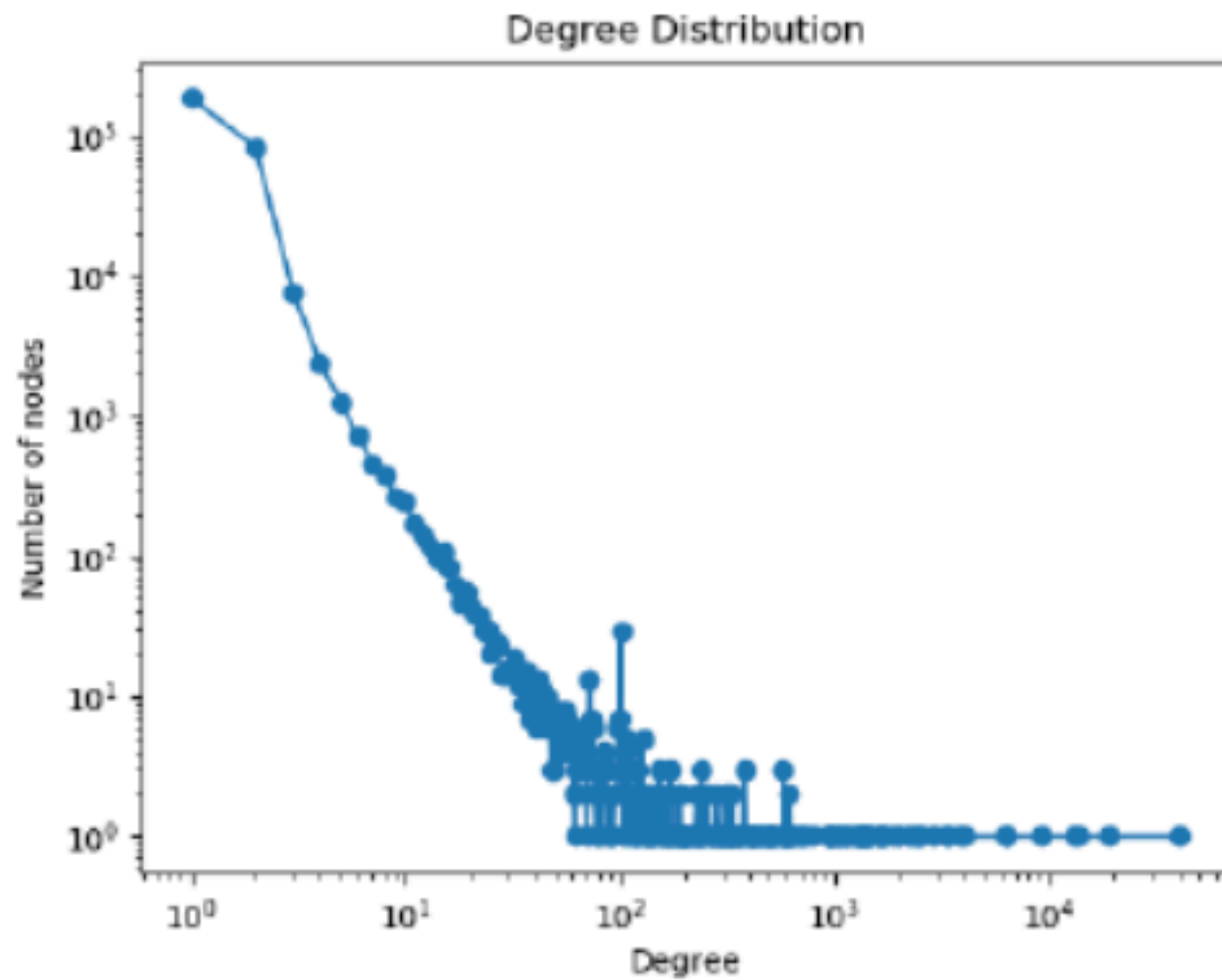
- Best practices contribute 1 or 2 nodes each transaction
- In practice this seems to be 50%

Degree Distributions

- Seems to be power law:

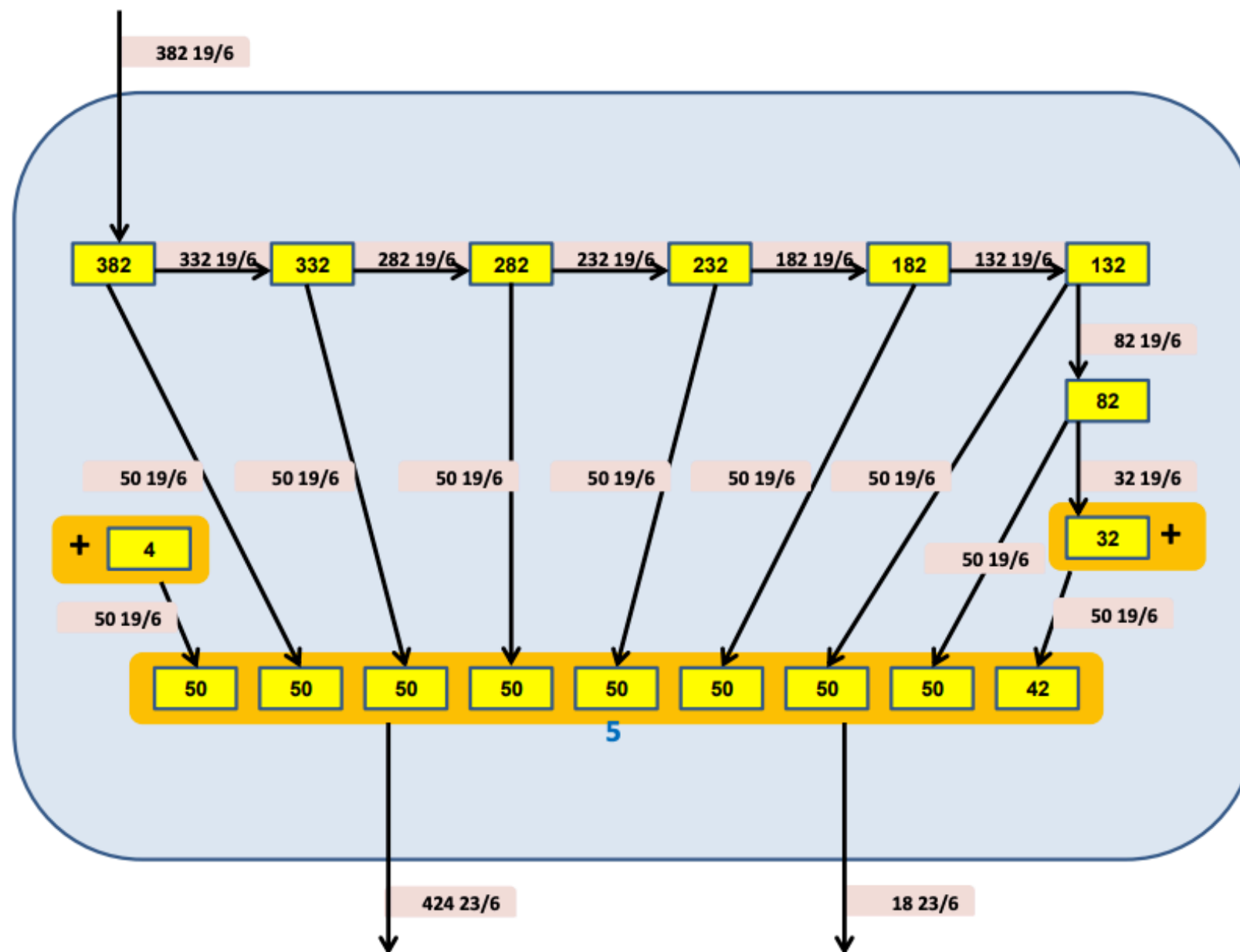


Ethereum



Transaction Patterns

- Fork-merge:
 - Large amount in wallet
 - Split into many smaller wallets
 - Finally after a long trip merged into single wallet
- Binary tree-like structure:
 - Transaction + Change
 - Splitting your amount into 2
- Long Chains



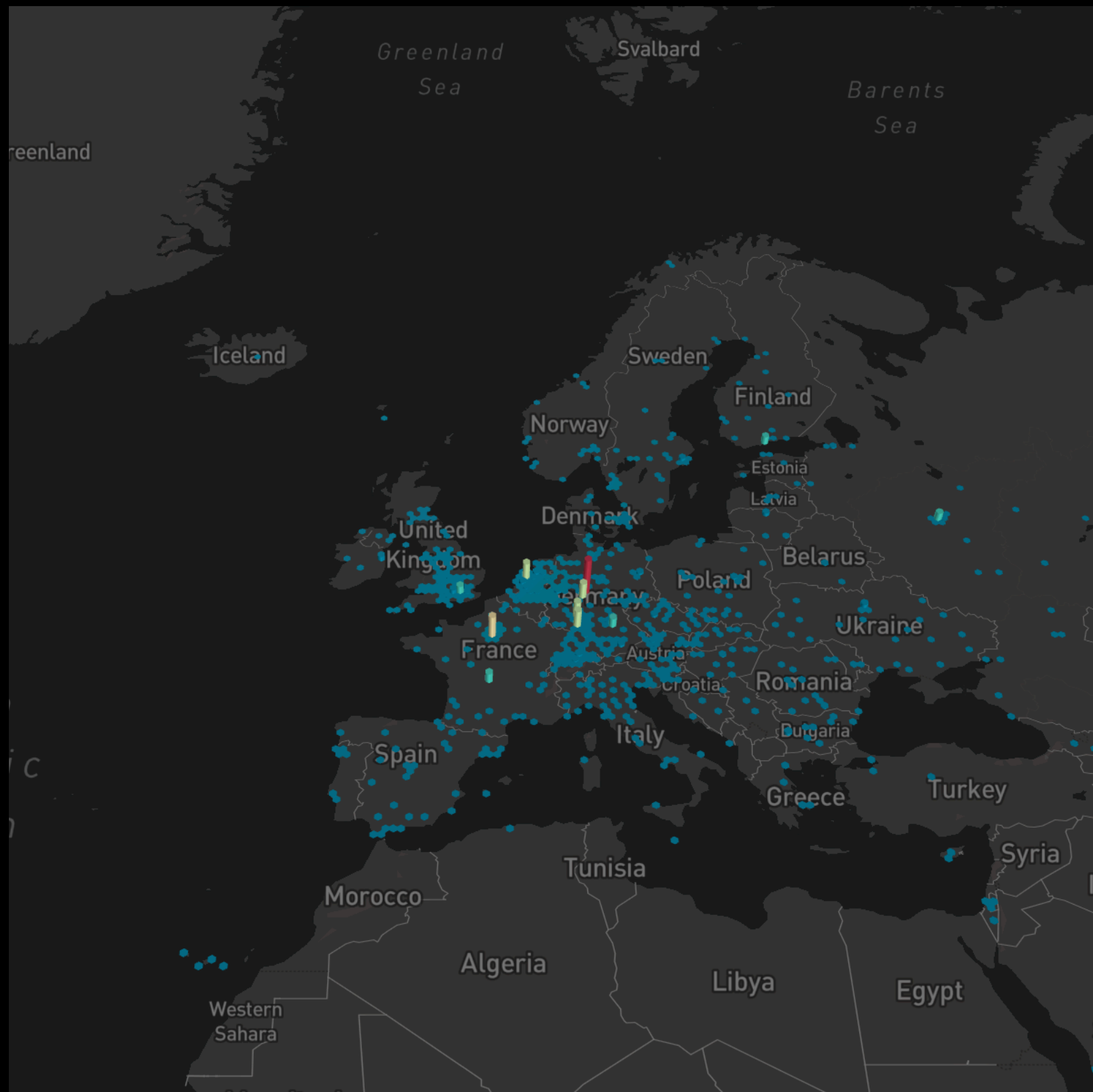
Insights From Degree

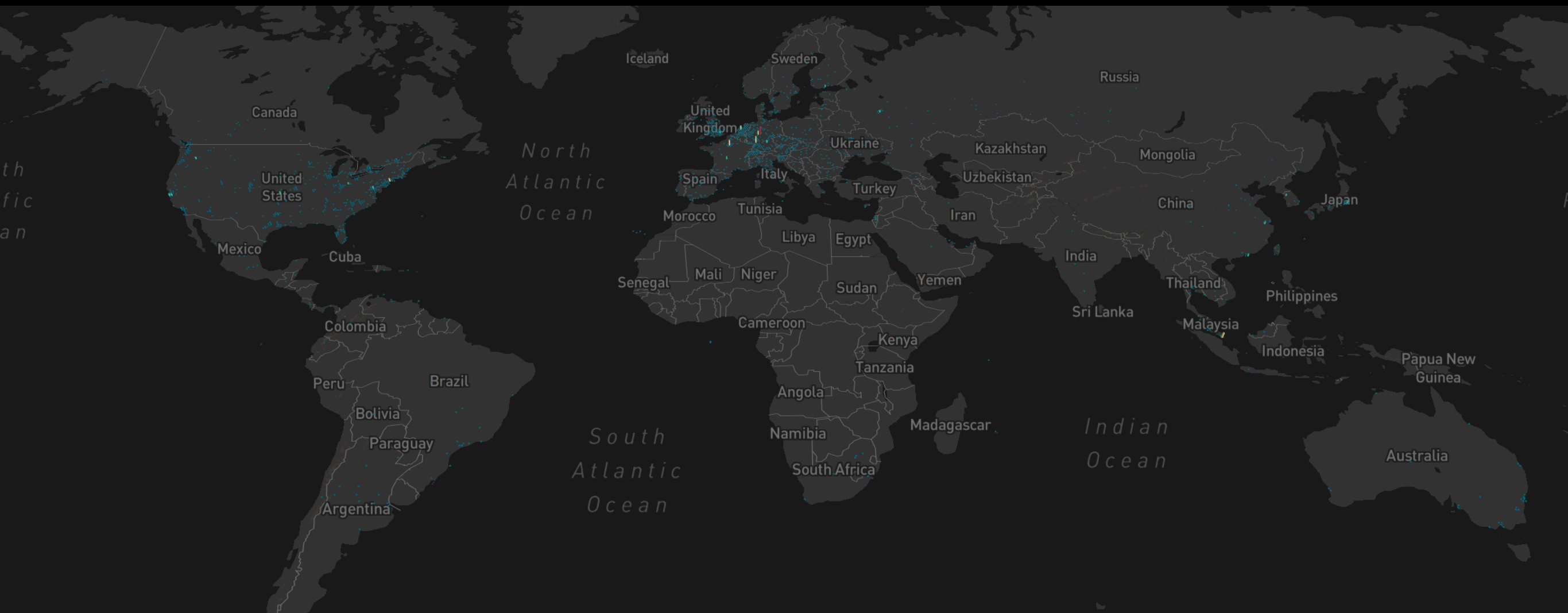
- What about degree 1:
 - Likely money transferred to same individual
- Large outdegree:
 - Possibly automated transaction

GeoSpatial

Hard Because

- Many won't expose an IP address
- Many won't respond to API calls that identify their address
- Not very trustworthy





Visit At

- https://blockchaincourse.onai.com/node_viz/

Questions?