Cryptocurrencies: challenges and caveats

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A new form of consensus

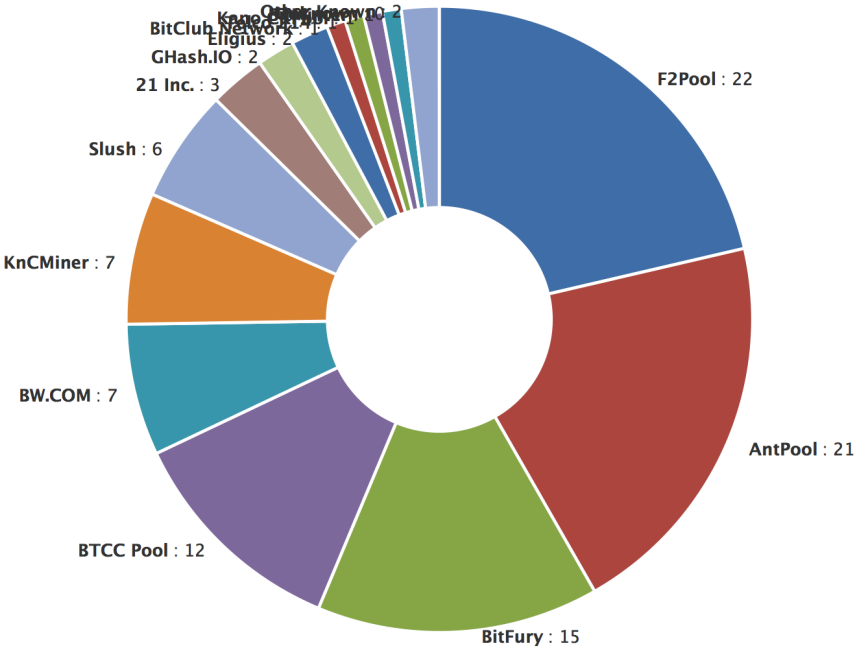
- Existing consensus mechanisms included voting, small groups, and *k* out of *n* signatures
- The blockchain mechanism is new as it scales without 'apparently' needing a central authority
- No pre-established trust is needed to maintain global consensus (the ledger of transactions)

The blockchain

- Signed transactions are sent to peers
- Transactions propagate in the network
- Transactions remain in limbo until a miner includes them in a block
- Miners compete to find a hash of the existing blockchain, plus the selected pending transactions, with a ‘special property’ which means they need about 2^{64} trials
- **New: the miner is not pre-(s)elected**

Is Bitcoin really decentralised?

- Mining pools: Satoshi didn't see this coming
- 50% of miners (or less) can control what transactions are mined (censorship?)
- They can collectively decide which mining software and policies will be enforced



The block size debate

- At present, Bitcoin blocks are limited to 1MB
- That means 7 transactions per second, (average one block mined per 10 minutes)
- Some developers want to increase this
- Who controls what software will be used? What modifications to the protocol will be enforced?

Energy consumption

- In early days, miners found hashes using software on their PCs (or other people's)
- Once bitcoins became valuable, firms started building custom hardware that turns electricity into hashes efficiently
- Major cost of mining a coin is energy
- In late 2016, the mining reward falls from 25 bitcoins to 12.5

Bitcoin: reputation and anonymity

- Silk Road: underground marketplace for drugs
- Idea: easy to create new identities (no central body to copy your passport and gas bill)
- But: the blockchain is completely public, so all transactions can be traced
- October 2013: Ross Ulbricht gets arrested
- Now: it's the mainstay of ransomware

Bitcoin: machine learning

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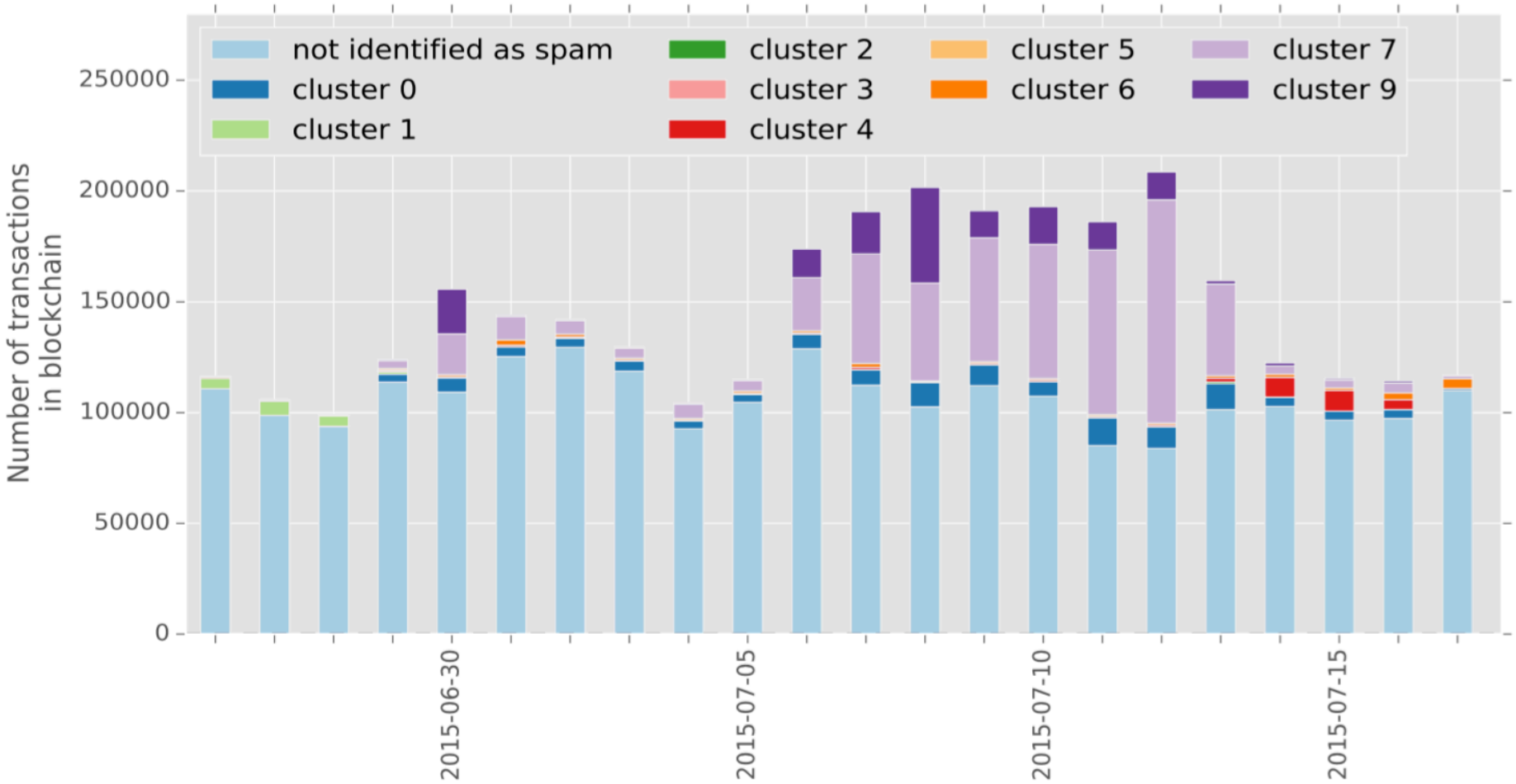

Summary

- The accumulation of power is a problem
- The privacy mechanism – free pseudonyms – isn't enough for businesses
- Fixing it so that its scales up properly is hard
- Problems: propagation delays, bandwidth, data storage, etc.
- Focus on resilience and censorship-resistance