



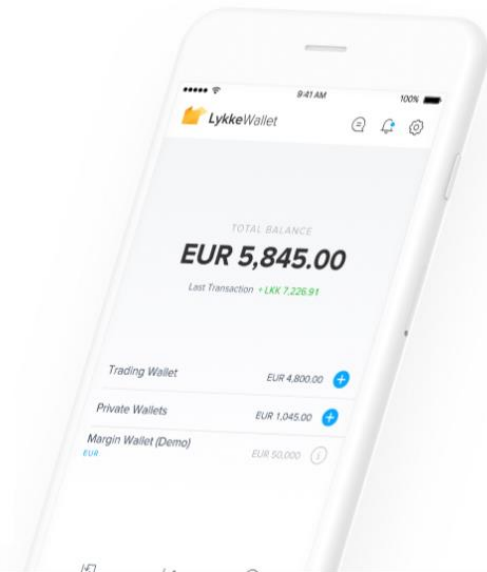
# Beyond Bitcoin: new social and economic order with Blockchain and Cryptocurrencies

Sergey Ivliev,

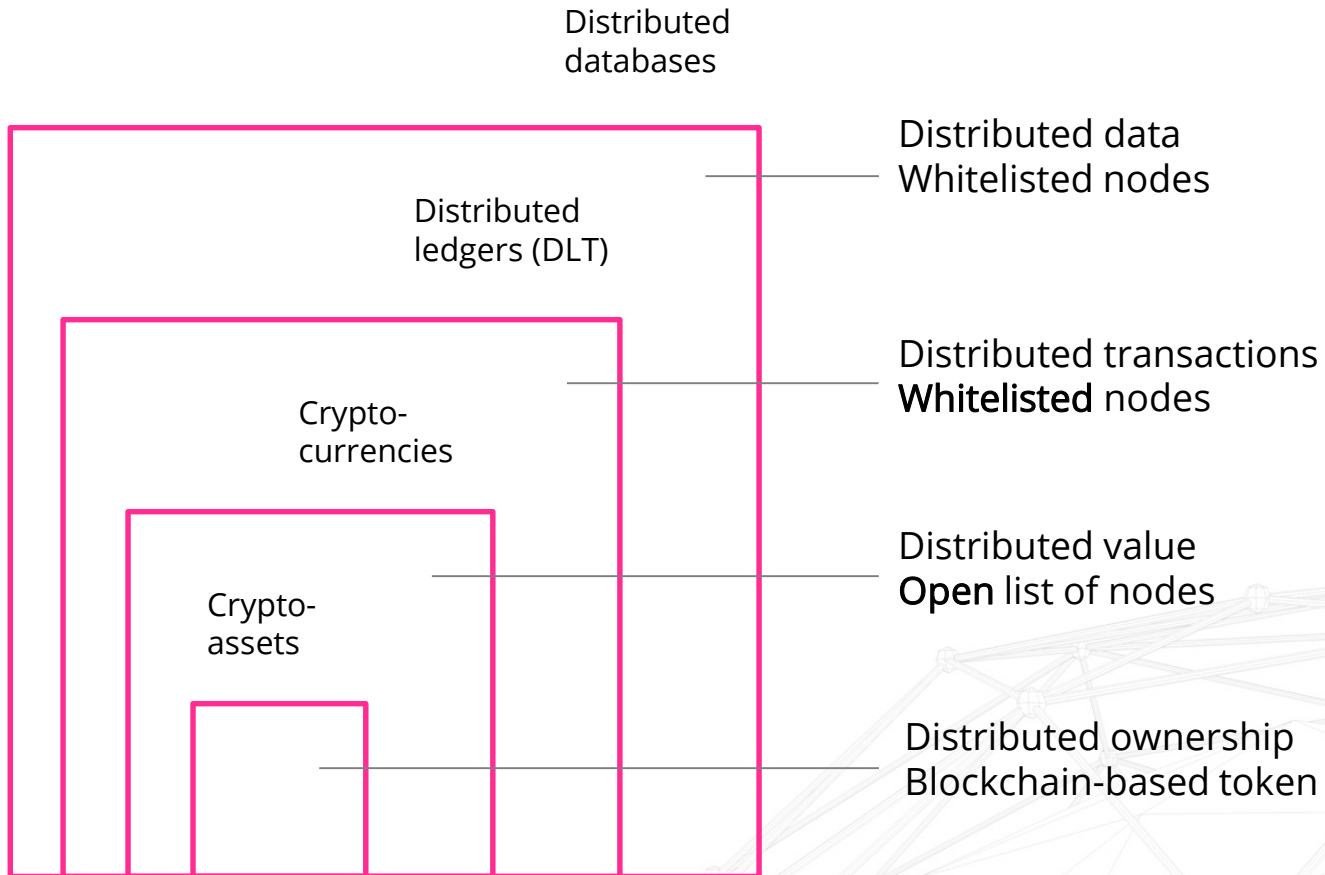
Co-founder of Lykke

Head of Cryptoeconomics & Blockchain Systems Lab, Perm State University

- Founded in 2015
- ICO in 2016
- Spot FX and crypto wallet (2016), margin trading (2017)
- Global tech team in 20+ countries
- 9m+ lines of code (Github @LykkeCity)
- 80k+ user accounts
- 170+ asset crosses
- \$1b+ traded volume

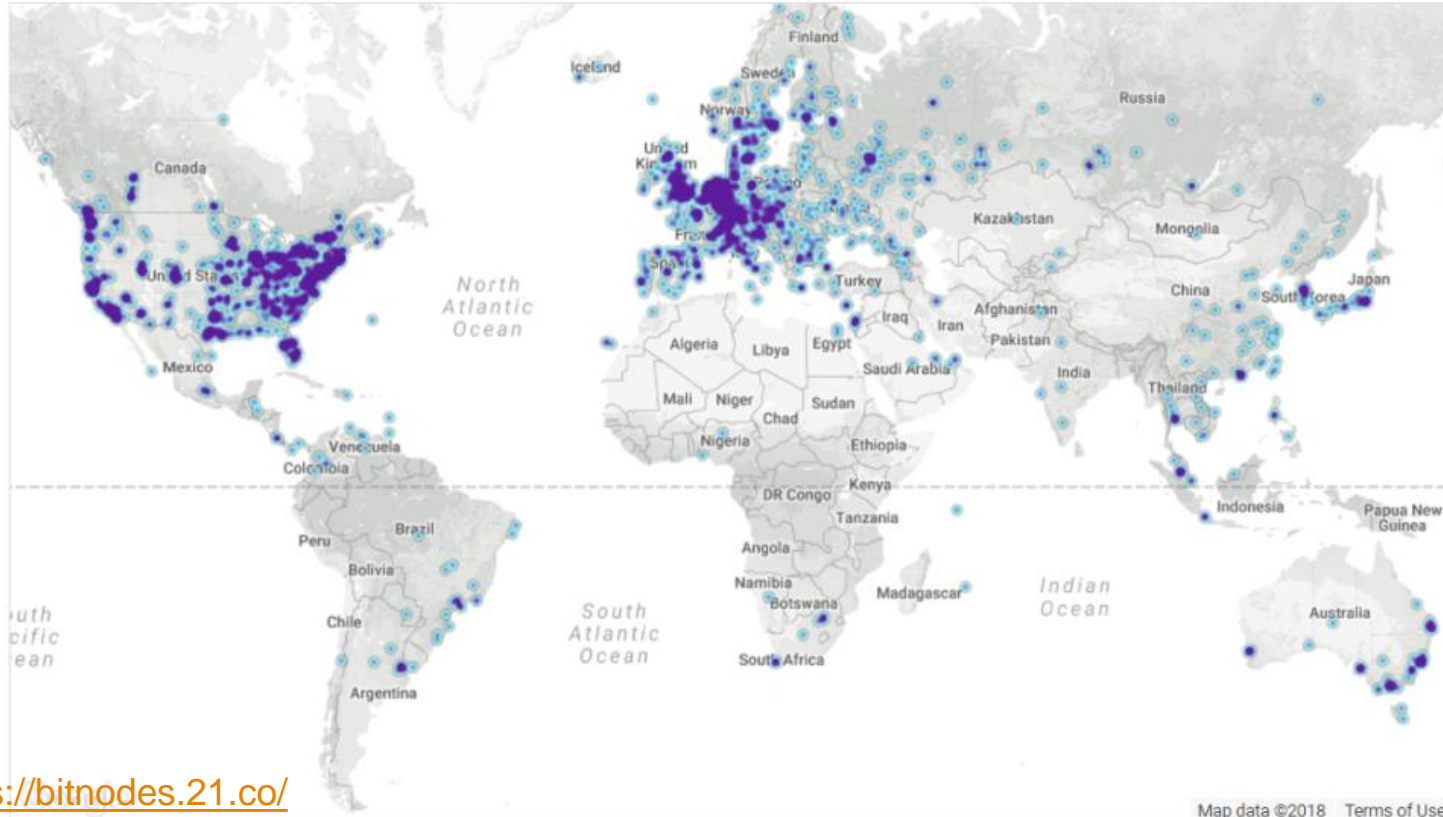


# Decentralized Consensus Protocols



# Open list of nodes

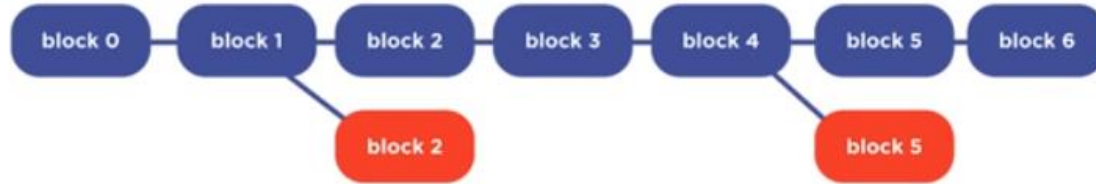
11500+ active full nodes in bitcoin (7 Apr)



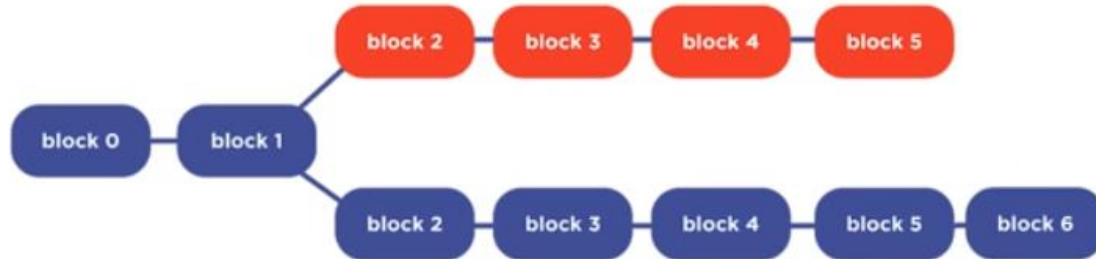
# Nakamoto Consensus

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## Normal Occasional Forking



## Rare Extended Forking



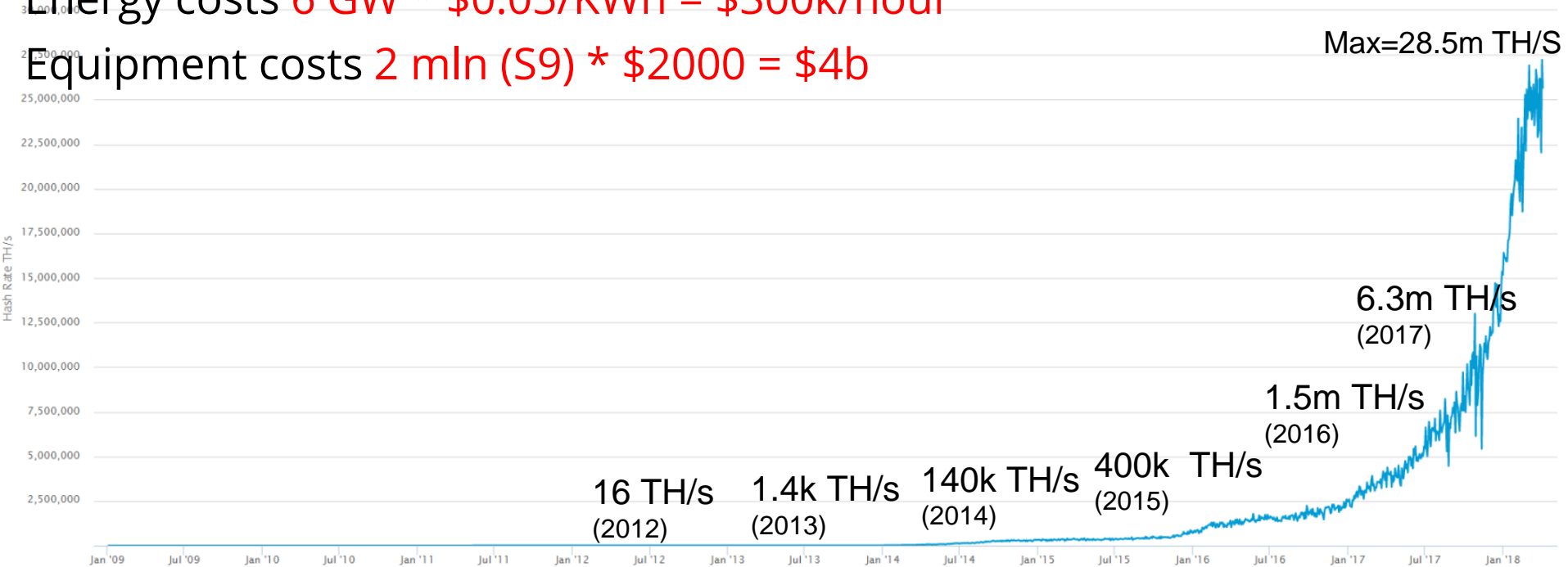
Satoshi Nakamoto "Bitcoin: Peer-to-Peer electronic cash system", 2008. <https://bitcoin.org/bitcoin.pdf>

# Bitcoin Hashrate

Bitcoin hashrate now exceeds **28 mln TH/s**. Power **~6 GW**

Energy costs **6 GW \* \$0.05/KWh = \$300k/hour**

Equipment costs **2 mln (S9) \* \$2000 = \$4b**

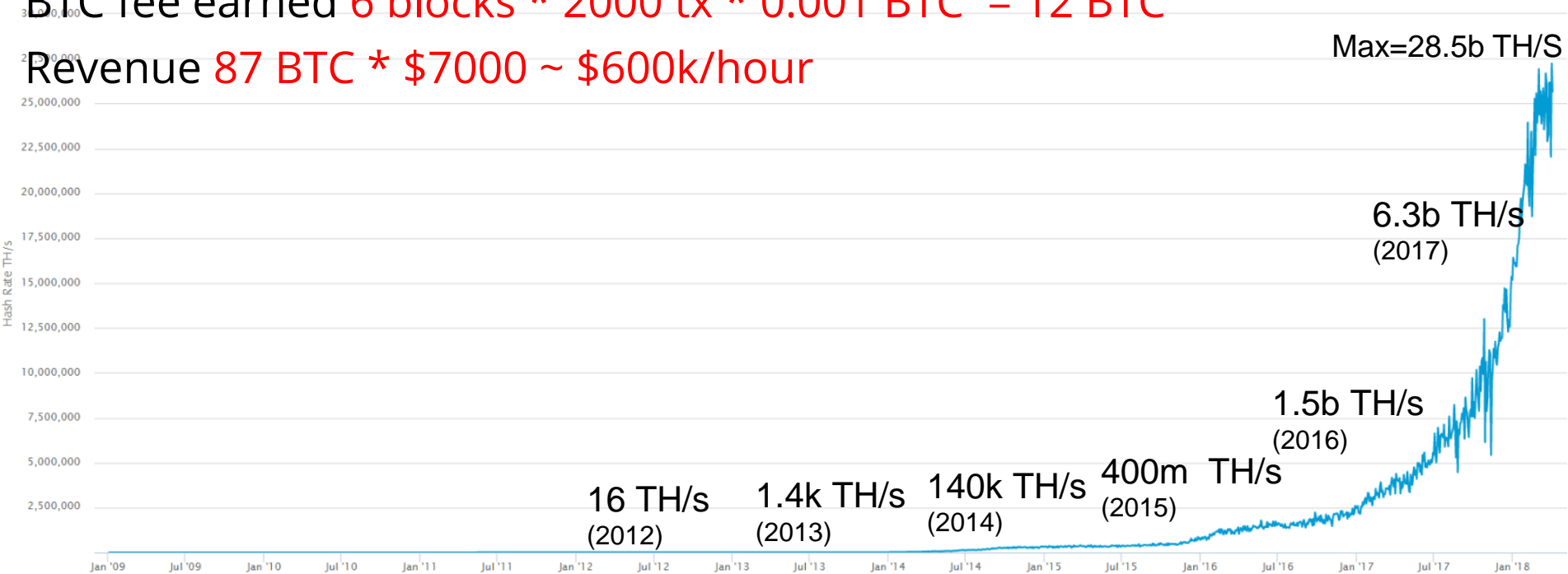


# Bitcoin Hashrate

BTC mined **6 blocks \* 12.5 BTC = 75 BTC**

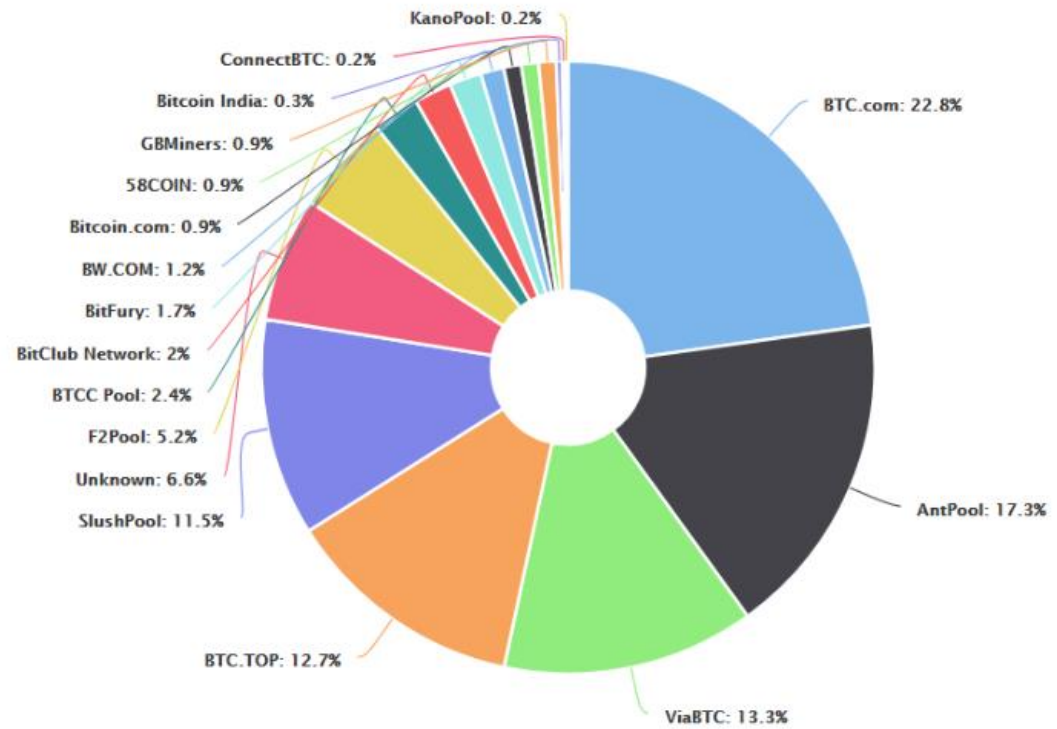
BTC fee earned **6 blocks \* 2000 tx \* 0.001 BTC = 12 BTC**

Revenue **87 BTC \* \$7000 ~ \$600k/hour**



# Hashrate distribution

## Miners consolidation, geographic concentration



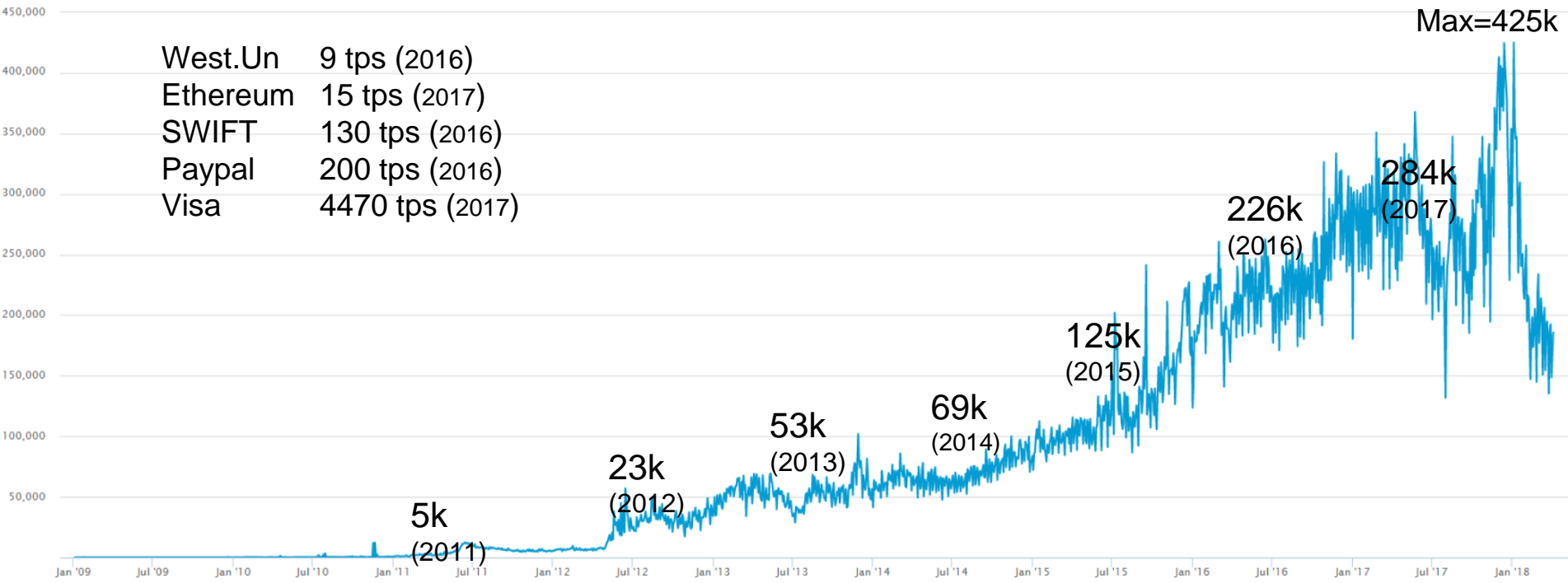
<https://blockchain.info/pools>





# Bitcoin transaction rate

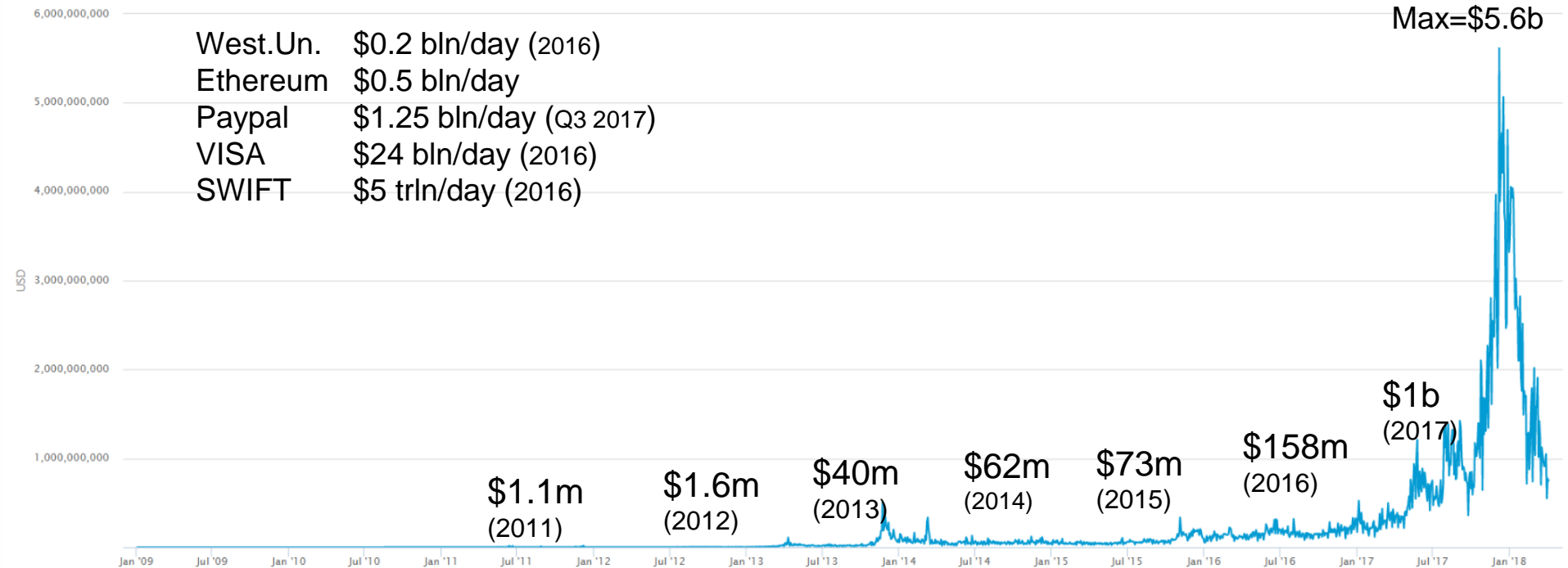
Bitcoin transactions peaked at **5 tps** in 2018



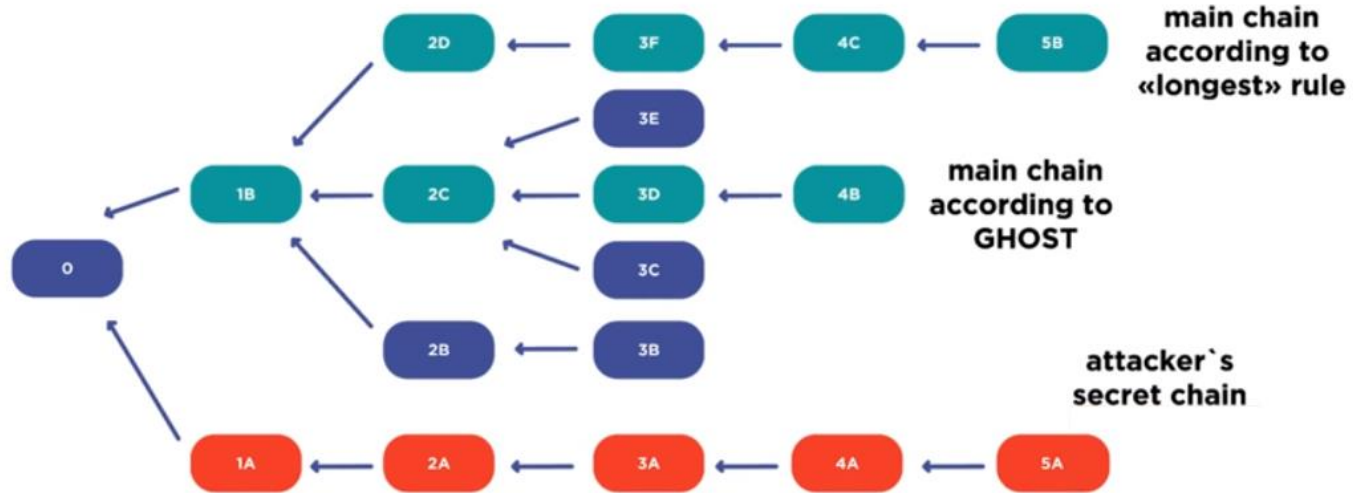
<https://blockchain.info/charts/n-transactions?timespan=all>

# Value transferred

Daily value transferred is around **\$1.5bln/day** in 2018



# GHOST Consensus



Y. Sompolinsky, A.Zohar "Secure High-Rate Transaction Processing in Bitcoin", 2013

# Ethereum transaction rate

Ethereum transactions peaked at **15.6 tps**



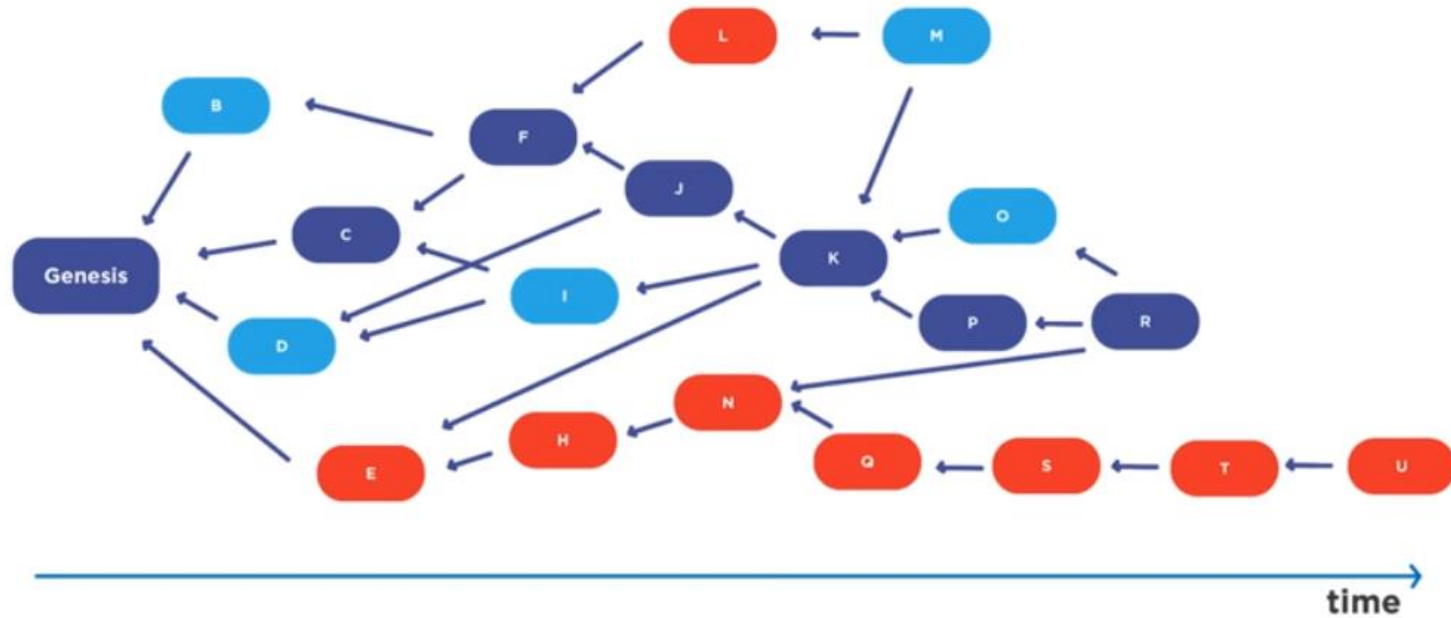
# Ethereum Smart Contracts

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- Turing-complete programming language
- Storage for a state
- Dapps
- DAO



# SPECTRE/PHANTOM Consensus

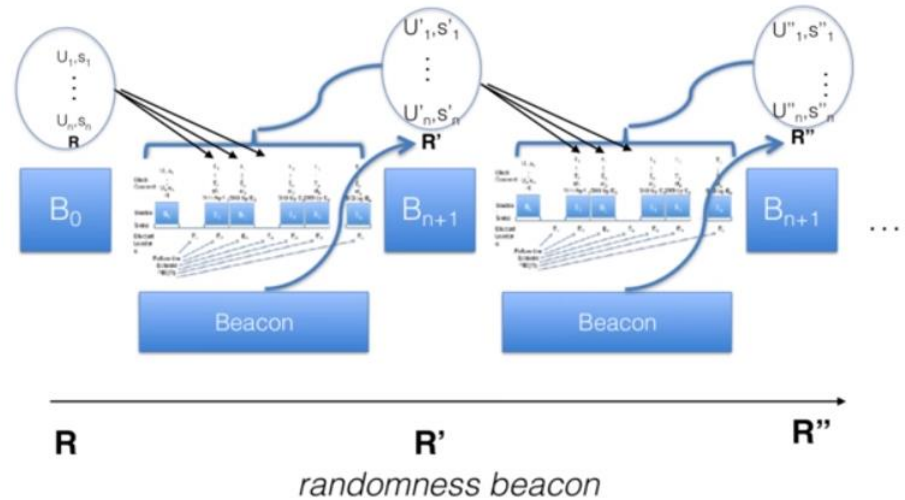


Y. Sompolinsky, A.Zohar "PHANTOM: A Scalable BlockDAG protocol", 2017

# Proof-of-Stake

PoS implementations:

- NXT, Peercoin
- Ouroboros / Cardano
- Casper / Ethereum
  
- Based on economics
- Much less energy consuming
- More complex



# On-chain Scaling

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- DAG

Byteball **17 tps** (<https://blog.goodaudience.com/byteball-main-net-under-stress-test>)

IOTA **100 tps**

RAIBlocks **300 tps** (<https://medium.com/@bnp117/stress-testing-the-raiblocks-network-part-ii>)

- Sharding + PoS:

Zilliqa **2.5k tps** (6 shards 3600 nodes)

RChain **100k tps** (projected)

- Sharding + aBFT:

Hedera Hashgraph **200k tps** (64 nodes in 8 regions)



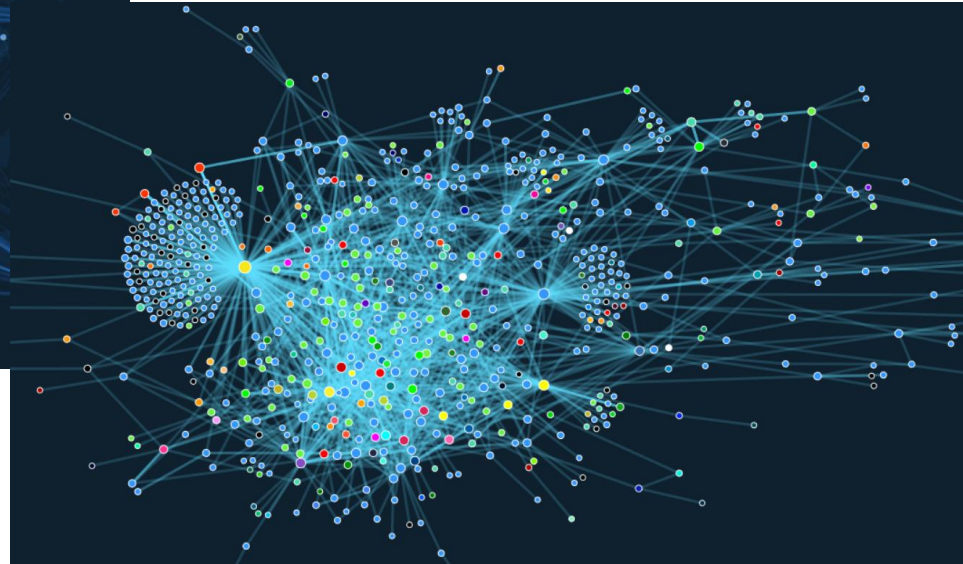


# Off-chain Scaling

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Bitcoin Lightning Network, Ethereum Raiden Network **100m tps** (projected)

Ethereum Plasma **1m tps** (projected)



Lightning network today: **4570**  
channels linking **1394** nodes

<https://lnmainnet.gaben.win/>

<https://explorer.acinq.co>

# World in 2035


A futuristic cityscape with tall, sleek skyscrapers and green spaces under a blue sky with light clouds. The city is built on a hillside, with a mix of modern and traditional architectural styles. The foreground shows a green field with a path and some structures, while the background is dominated by a dense cluster of high-rise buildings.

**6 bln**

People in cities

**50 bln**

IoT devices



Digital ID: e-Voting, Wallets

Tokenized assets & Crowdfunding

Censorship-free Social Networks

Shared hardware (Fog computing,  
Distributed file storage, Decentralized CDN)

Cryptofinance & Digital markets protocols

Micropayments, IoT/EoT

Smart industries

Smart cities (smart property, smart mobility,  
realtime energy trading)