# Examining scaling techniques

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to Mike ▾

Hi Mike,

I'm glad to answer any questions you have.  If I get time, I ought to write a FAQ to supplement the paper.

There is only one global chain.

The existing Visa credit card network processes about 15 million Internet purchases per day worldwide.  Bitcoin can already scale much larger than that with existing hardware for a fraction of the cost.  It never really hits a scale ceiling.  If you're interested, I can go over the ways it would cope with extreme size.

By Moore's Law, we can expect hardware speed to be 10 times faster in 5 years and 100 times faster in 10.  Even if Bitcoin grows at crazy adoption rates, I think computer speeds will stay ahead of the number of transactions.
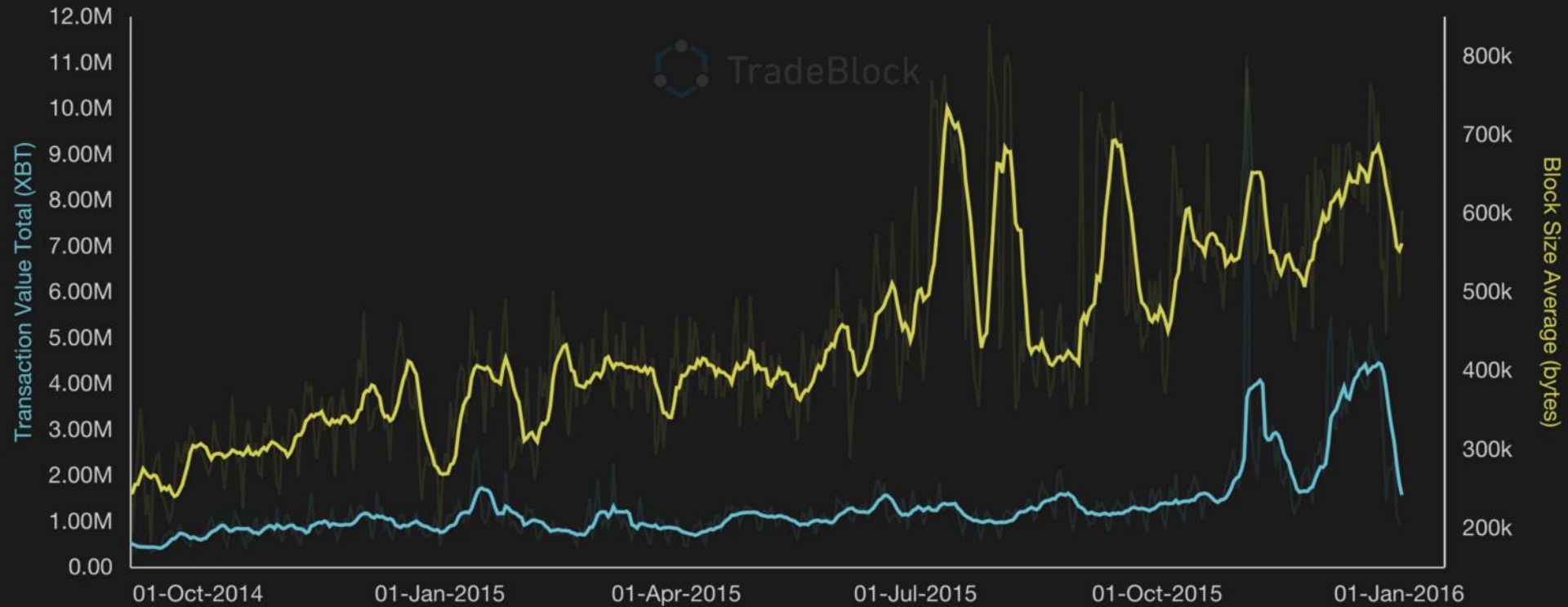
HOMESTEAD

ethereum.org

# Primary throughput techniques

1. Partial ledger visibility with UTXO

2. Multiple notary clusters

   (a.k.a. sharding. also gains: algorithmic agility)

3. Massive parallelism

# Secondary throughput techniques

1. Chain snipping

2. JIT compilation

3. Signatures of attestation

4. Separate machines for Firewall/MQ/DB/Flow processing

# Future throughput techniques

1. Horizontally scalable node

2. Horizontally scalable tx store

# Headline numbers

- Can scale networks 'infinitely'
- Corda Enterprise: 800tps per node
- DTCC network test: **20,000tps+**
- Current node bottlenecks are:
    - Disk space
    - Cloud
    - Multi-machine flow processing
    - DB throughput

- **But ... PayPal: only ~300tps!**

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# Blockchains rarely have horizontal nodes

| Option # | Processor | Processor Speed | Physical Cores | Logical Cores | RAM | HDD | Price |
|---|---|---|---|---|---|---|---|
| 1 | 4 X 8 Core X7550 | 2.0Ghz | 32 | 64 | 256Gb | 3 X 300Gb 10K SAS | $1,800 |
| 2 | 4 X 8 Core X7550 | 2.0Ghz | 32 | 64 | 512Gb | 3 X 300Gb 10K SAS | $2,800 |
| 3 | 4 X 8 Core X7550 | 2.0Ghz | 32 | 64 | 1Tb | 3 X 300Gb 10K SAS | $5,800 |
| 4 | 4 X 10 Core E7-4860 | 2.20Ghz | 40 | 80 | 256Gb | 3 X 300Gb 10K SAS | $2,000 |
| 5 | 4 X 10 Core E7-4860 | 2.20Ghz | 40 | 80 | 512Gb | 3 X 300Gb 10K SAS | $3,000 |
| 6 | 4 X 10 Core E7-4860 | 2.20Ghz | 40 | 80 | 1Tb | 3 X 300Gb 10K SAS | $6,000 |

"Scale-up vs scale-out for Hadoop: Time to rethink?"
MSR 2013

"We present an evaluation across 11 representative Hadoop jobs that shows scale-up to be competitive in all cases and significantly better in some cases, than scale-out."

# It's about more than throughput

- Number of **nodes** which interop
- Number of **applications**
- Number of **developers**

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# Thank you

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