

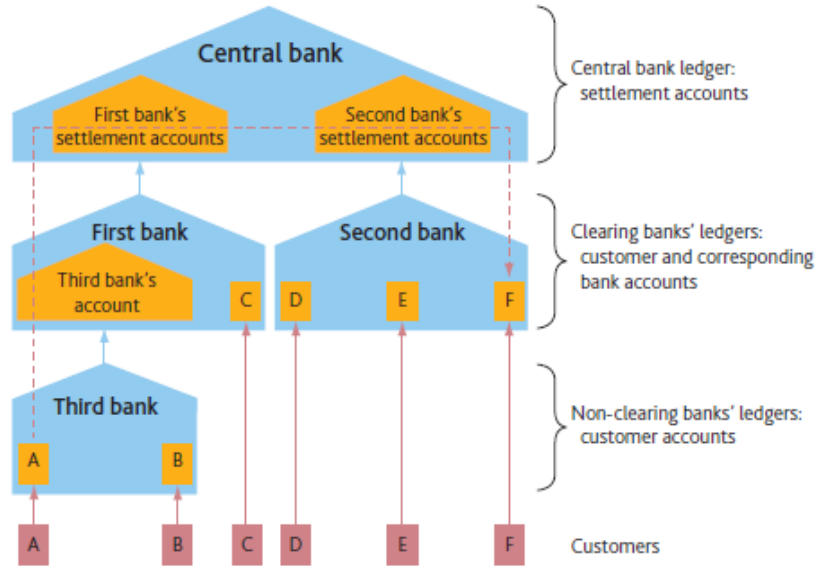
Finance on The Blockchain

Sergey Ivliev

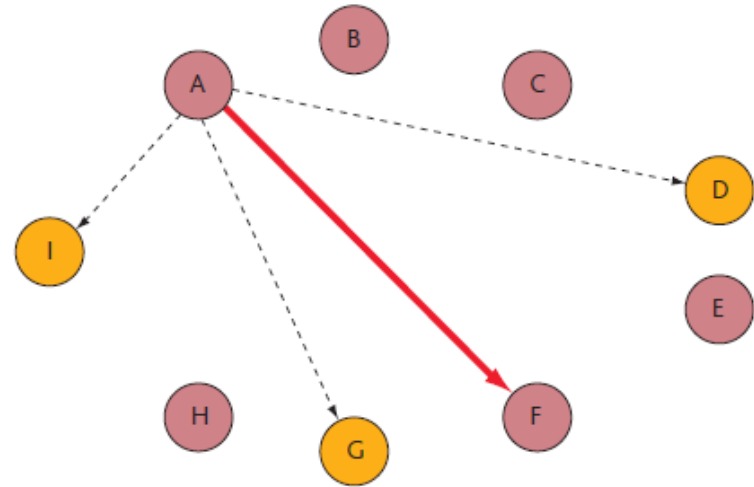
Perm Summer School 2017



Centralized vs. Decentralized

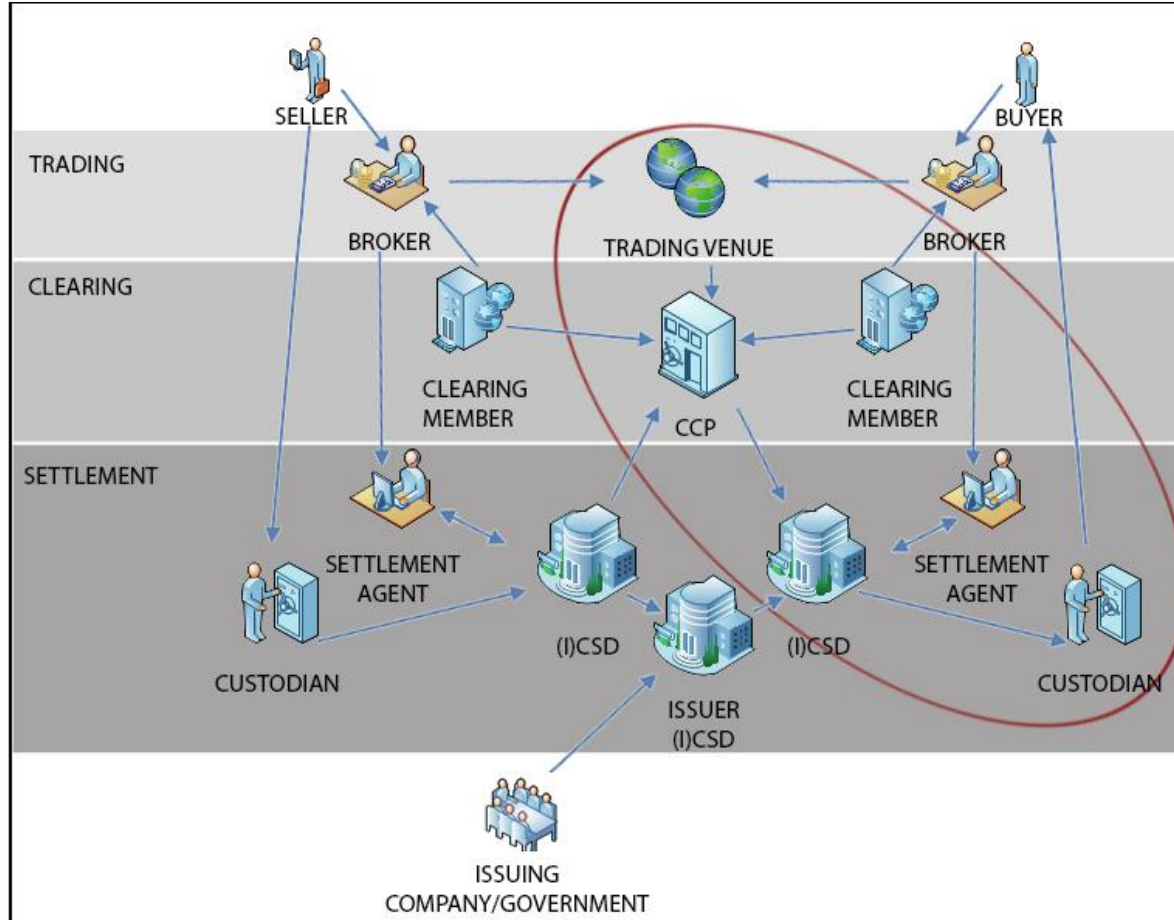


Centralized payment system

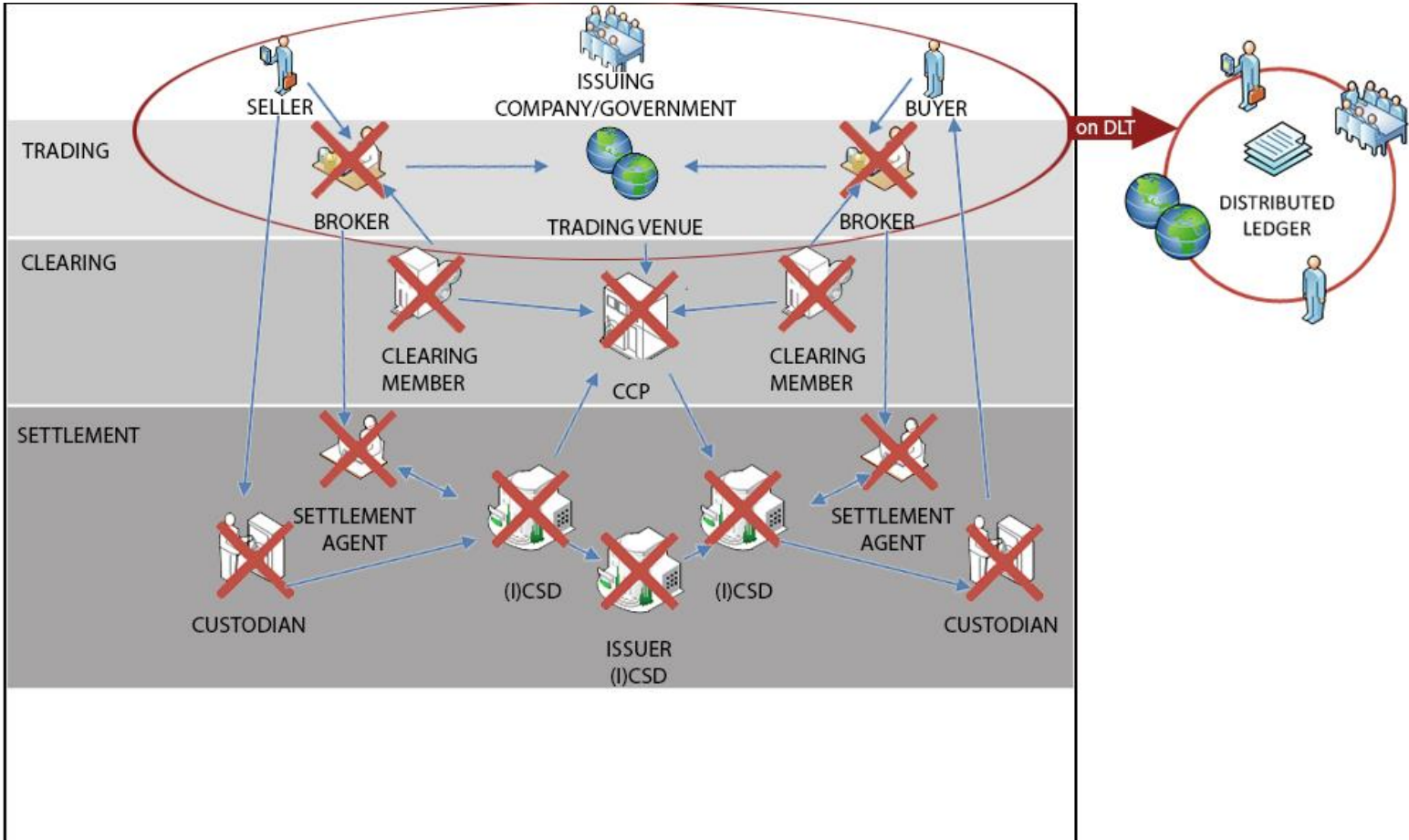


Decentralized payment system

Centralized vs. Decentralized



Centralized vs. Decentralized



Public Blockchains Properties

- Shared ledger: wallets, timestamped transactions, UTXO, balances
- Secure store of value / titles / data (*but slow and limited*)
- Programmable money / Smart contracts / Dapps (*runtime error*)
- Immutable and censorship resistant (*cyber risk*)
- Easily accessible and transparent (*privacy? Permissioned?*)
- Decentralized architecture (*governance? concentration? legal?*)



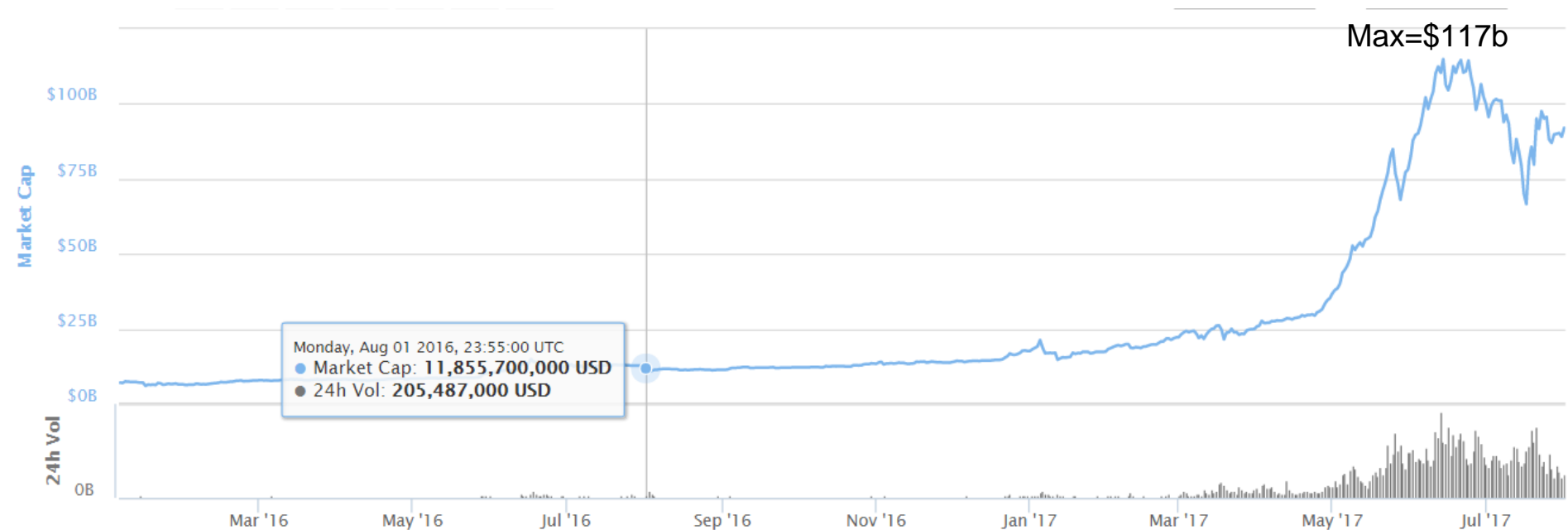
Ontology

- Closed economy vs. Open economy
- Native blockchain vs. Platform token
- Pre-mined vs. Fixed supply vs. Open supply
- Dapps: payments, smart contracts, asset issuance, computing, storage



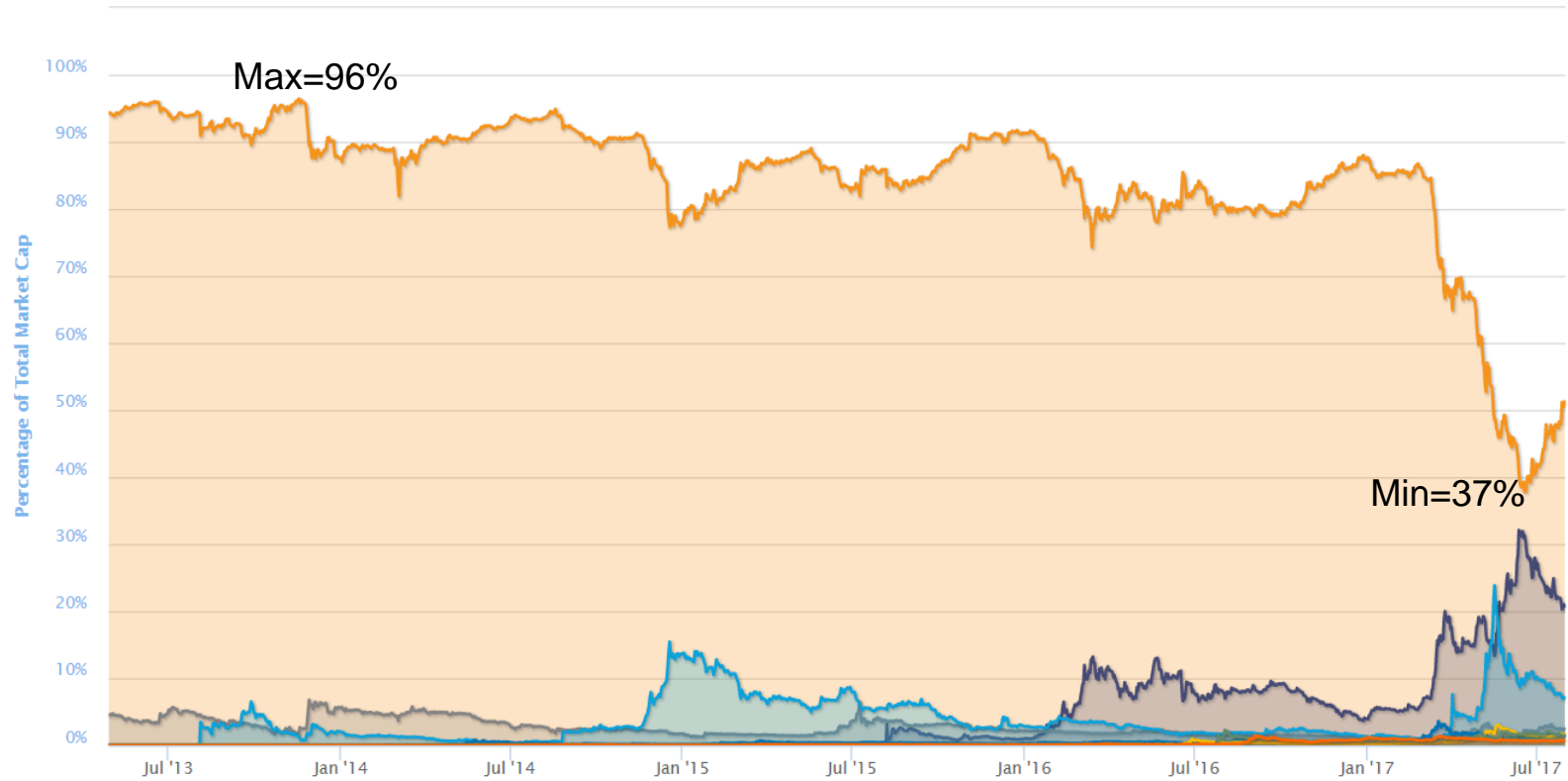
Cryptocurrencies + digital assets

Total size of cryptoeconomics is around \$90 bln today



Bitcoin dominance

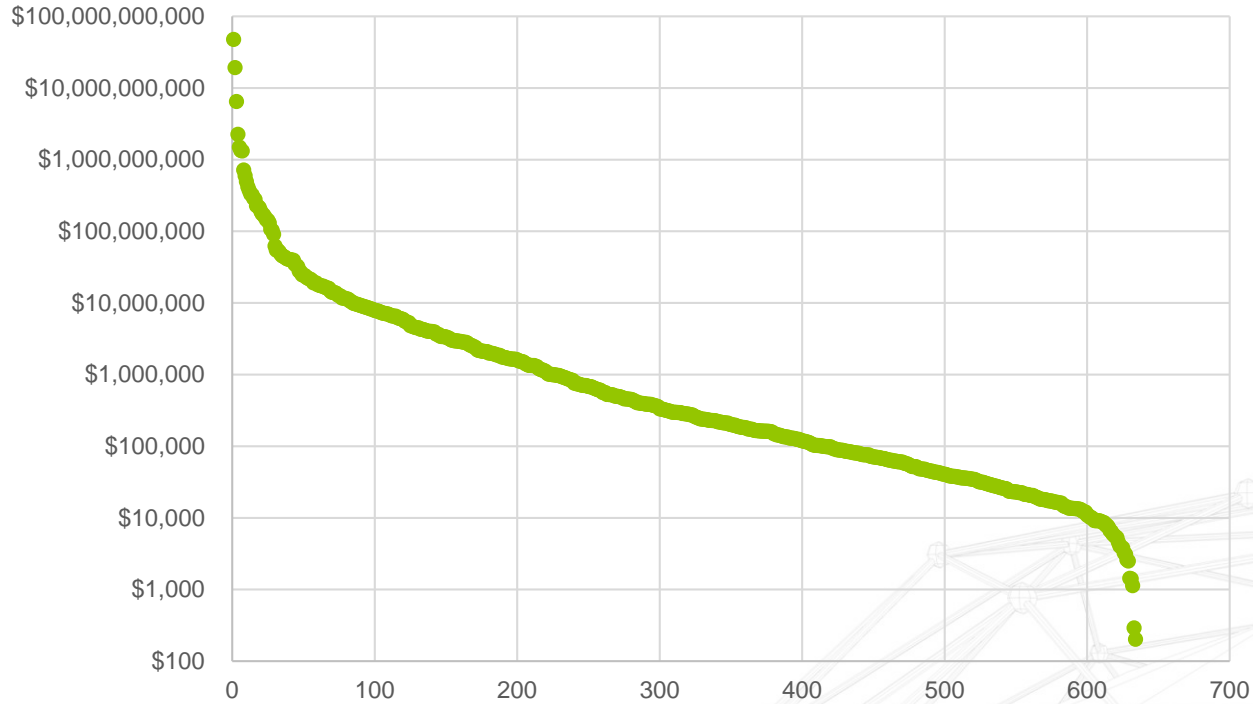
...with a bitcoin as a dominating asset, so far






















<https://coinmarketcap.com/charts/>

Cryptocurrencies

635 cryptocurrencies, \$87 bln market cap



▲#	Name	Symbol	Market Cap	Price	Circulating Supply	Volume (24h)	% 1h	% 24h	% 7d
1	 Bitcoin	BTC	\$47,388,334,773	\$2875.34	16,480,950	\$860,575,000	0.32%	4.52%	4.56%
2	 Ethereum	ETH	\$19,179,149,190	\$204.69	93,699,431	\$571,286,000	0.99%	3.76%	-8.66%
3	 Ripple	XRP	\$6,440,879,227	\$0.168024	38,333,090,674 *	\$57,424,900	0.18%	1.87%	-12.46%
4	 Litecoin	LTC	\$2,248,110,425	\$43.02	52,258,182	\$237,651,000	0.01%	6.66%	-3.43%
5	 NEM	XEM	\$1,490,445,000	\$0.165605	8,999,999,999 *	\$2,887,010	0.32%	2.65%	-2.55%
6	 Dash	DASH	\$1,336,812,433	\$179.20	7,460,057	\$29,421,200	0.39%	3.42%	-13.43%
7	 Ethereum Classic	ETC	\$1,319,168,453	\$14.02	94,095,928	\$41,329,000	0.24%	1.52%	-11.68%
8	 IOTA	MIOTA	\$713,408,140	\$0.256665	2,779,530,283 *	\$2,586,540	2.35%	0.92%	-3.59%
9	 Monero	XMR	\$592,886,417	\$39.88	14,866,537	\$13,112,300	-0.01%	0.72%	-11.56%
10	 Stratis	STRAT	\$494,159,637	\$5.02	98,485,259 *	\$8,785,330	-0.07%	4.42%	-13.23%
11	 BitConnect	BCC	\$416,440,803	\$65.98	6,311,622	\$1,565,660	0.72%	7.68%	0.48%
12	 NEO	ANS	\$368,123,000	\$7.36	50,000,000 *	\$10,871,800	0.88%	3.52%	-11.80%
13	 Zcash	ZEC	\$328,297,086	\$176.32	1,861,981	\$28,589,500	0.41%	0.89%	-15.05%
14	 BitShares	BTS	\$321,719,519	\$0.123865	2,597,340,000 *	\$26,595,800	0.24%	-1.26%	-26.59%

	 Bitcoin <small>(explorer, top100)</small>	 Ethereum	 Litecoin <small>(explorer, top100)</small>	 Dash <small>(explorer, top100)</small>	 Monero	 Dogecoin <small>(explorer, top100)</small>
Market Capitalization	\$47,061,997,573 USD	\$18,773,626,177 USD	\$2,203,423,443 USD	\$1,323,020,770 USD	\$592,671,566 USD	\$183,682,012 USD
Transactions last 24h	228,298	249,889	18,450	6,208	3,194	14,669
Transactions avg. per hour	9,512	10,412	769	259	133	611
Sent last 24h	2,923,416 BTC (\$8,354,515,807 USD) 17.75% market cap	8,729,501 ETH (\$1,749,976,174 USD) 9.32% market cap	17,676,089 LTC (\$745,299,417 USD) 33.82% market cap	1,877,825 DASH (\$332,986,641 USD) 25.17% market cap		12,436,932,307 DOGE (\$20,692,050 USD) 11.27% market cap
Sent avg. per hour	121,809 BTC (\$348,104,825 USD)	363,729 ETH (\$72,915,674 USD)	736,504 LTC (\$31,054,142 USD)	78,243 DASH (\$13,874,443 USD)		518,205,513 DOGE (\$862,169 USD)
Avg. Transaction Value	12.81 BTC (\$36,595 USD)	34.93 ETH (\$7,003 USD)	958.05 LTC (\$40,396 USD)	302.48 DASH (\$53,638 USD)		847,838 DOGE (\$1,411 USD)
Median Transaction Value	0.223 BTC (\$636.28 USD)	0.112 ETH (\$22.44 USD)	15.28 LTC (\$644.31 USD)	2.42 DASH (\$429.82 USD)		10,252.52 DOGE (\$17.06 USD)
Reward Per Block	12.50 BTC (\$35,722.41 USD)	5 ETH (\$1,002.33 USD)	25 LTC (\$1,054.11 USD)	3.60 DASH (\$638.9 USD)	6.83 XMR (\$272.13 USD)	10,000 DOGE (\$16.64 USD)
Reward last 24h	1,788 BTC (\$5,108,304.19 USD)	22,580 ETH (\$4,526,543.21 USD)	14,200 LTC (\$598,732.65 USD)	1,992 DASH (\$353,309.51 USD)	5,096 XMR (\$203,128.92 USD)	13,730,000 DOGE (\$22,843.4 USD)

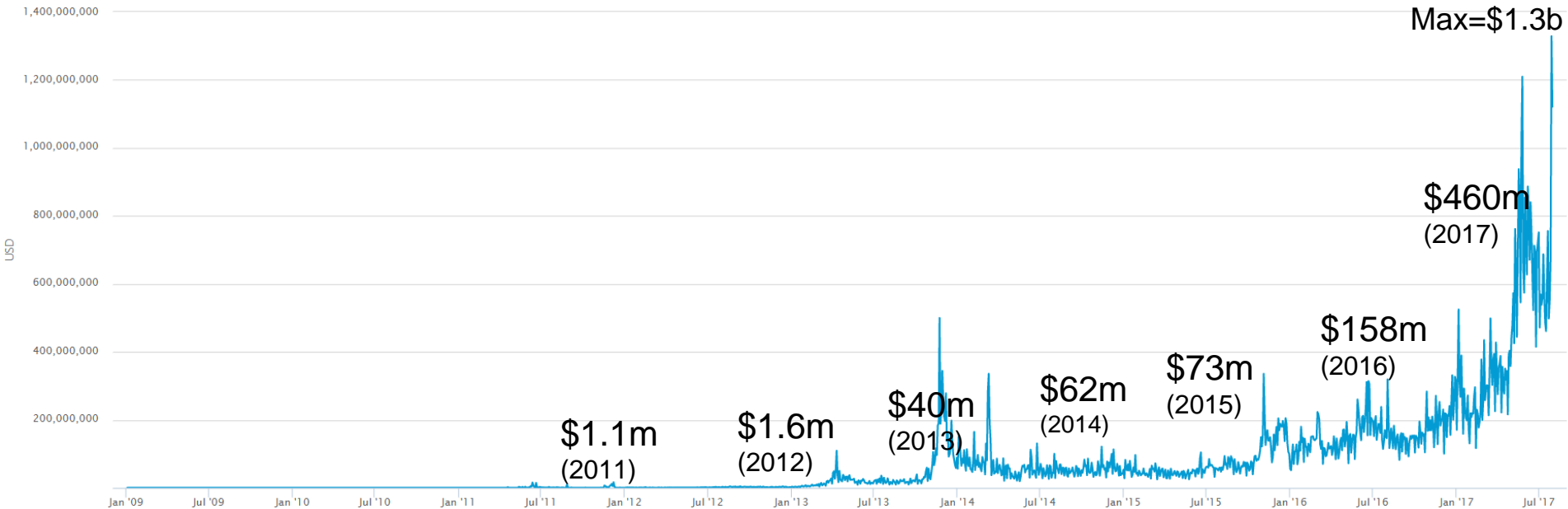
USD value sent

Value transferred is all time high

Estimated USD Transaction Value

The Estimated Transaction Value in USD value.

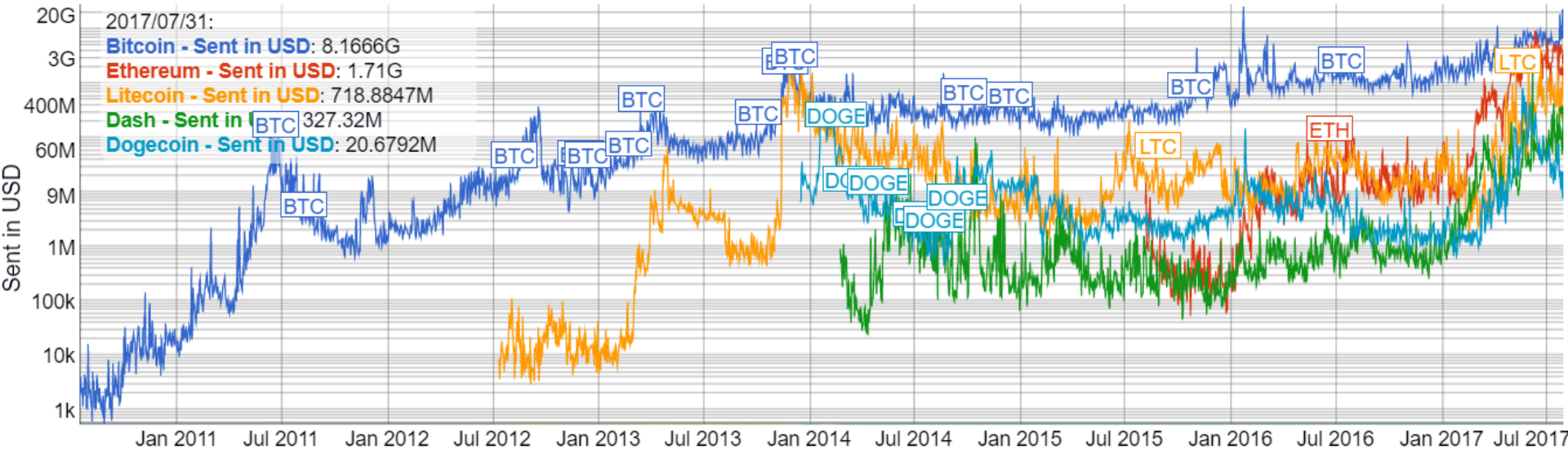
Source: blockchain.info



<https://blockchain.info/charts/estimated-transaction-volume-usd?timespan=all>

USD value sent

Total USD value of transactions > daily global remittance (\$1.5 bln/day)



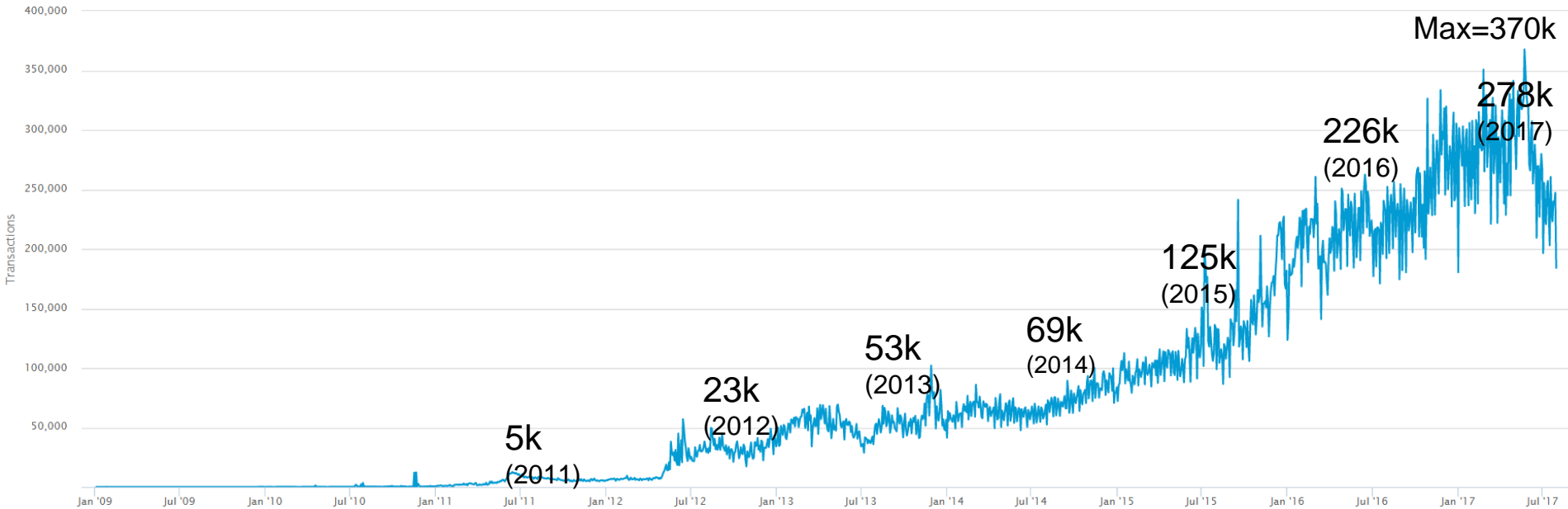
Transaction rate

Bitcoin transactions can double every 2 years, but reached the limit

Confirmed Transactions Per Day

The number of daily confirmed Bitcoin transactions.

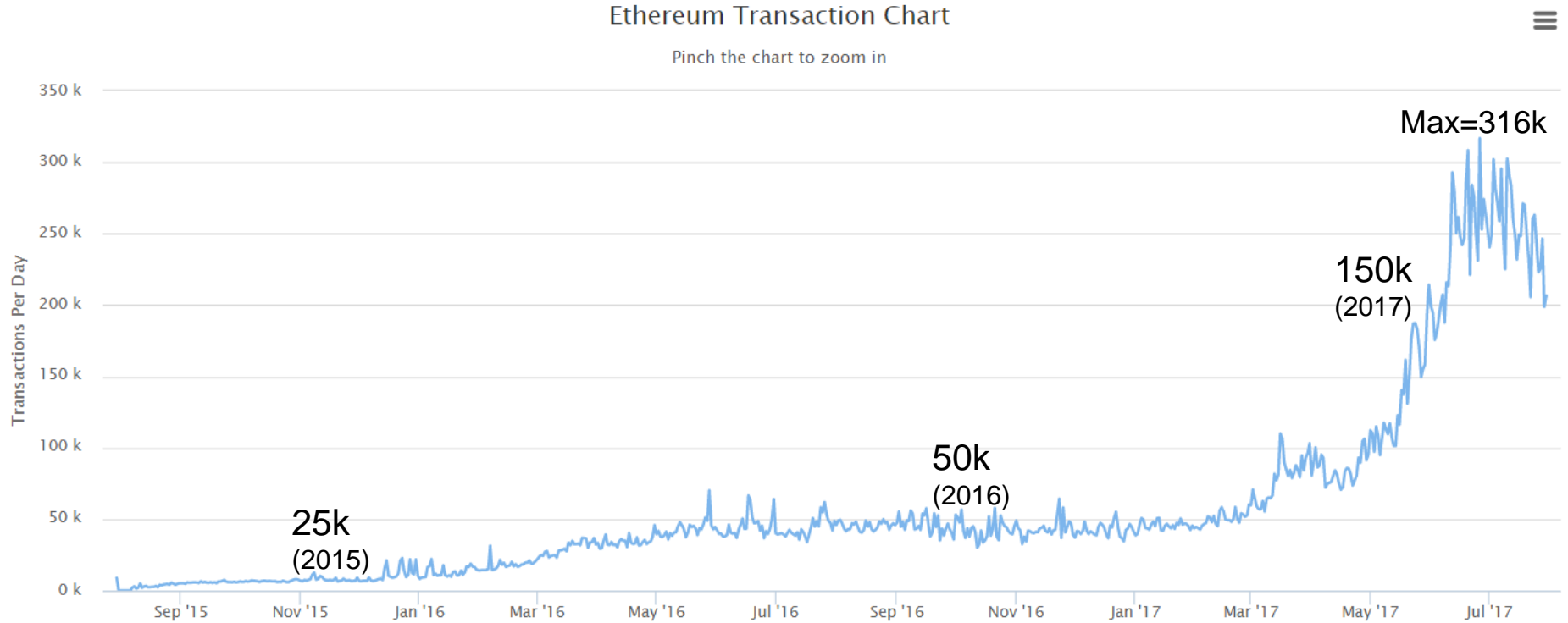
Source: blockchain.info



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

Transaction rate

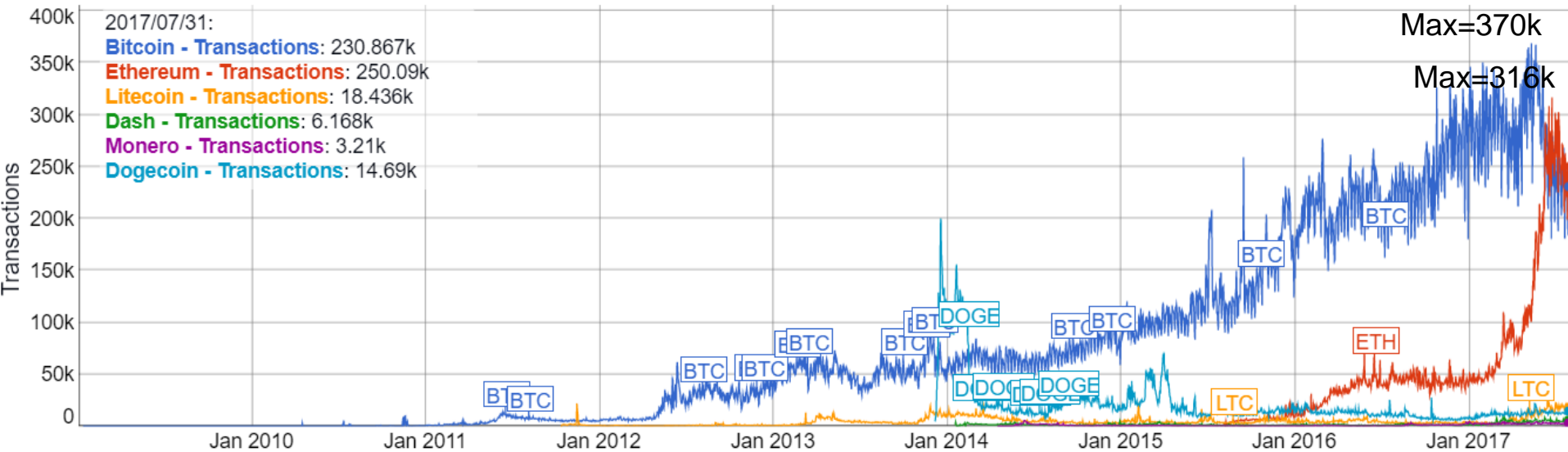
Ethereum was on the rise, but reached the limit too



<https://etherscan.io/chart/tx>

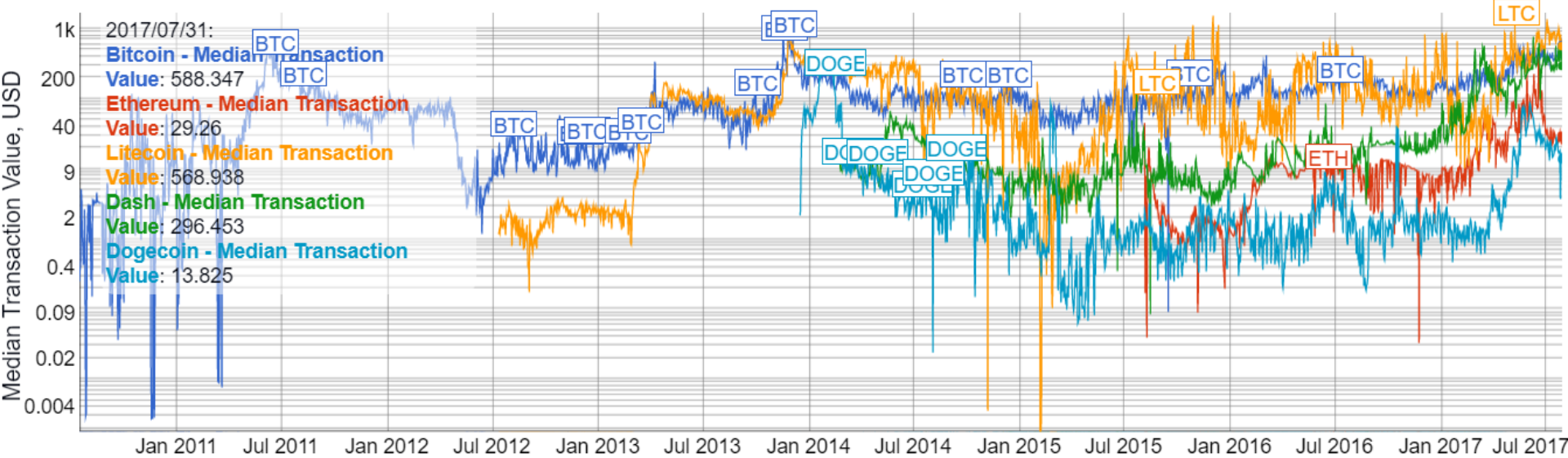
Transaction rate

Ethereum has overcome Bitcoin by number of transactions



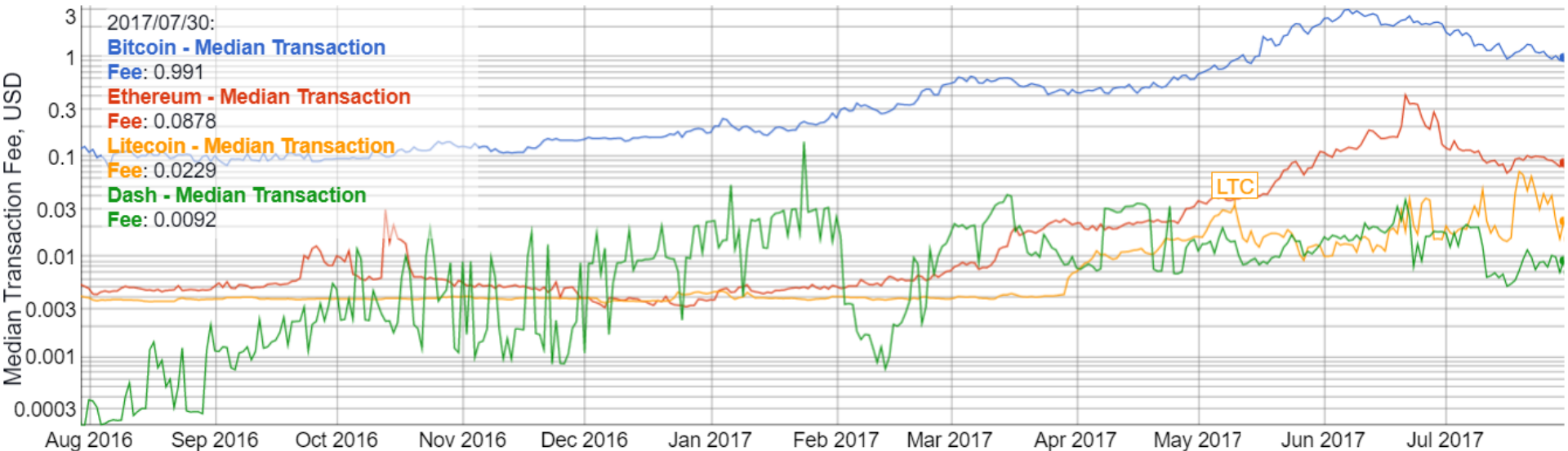
Transaction size

Bitcoin & Litecoin ~\$500 / tx, 2x Dash, 20x Ethereum & Dogecoin



Transaction cost

Bitcoin median transaction fee is \$1, 10x Ethereum, 100x of Dash



Mining power

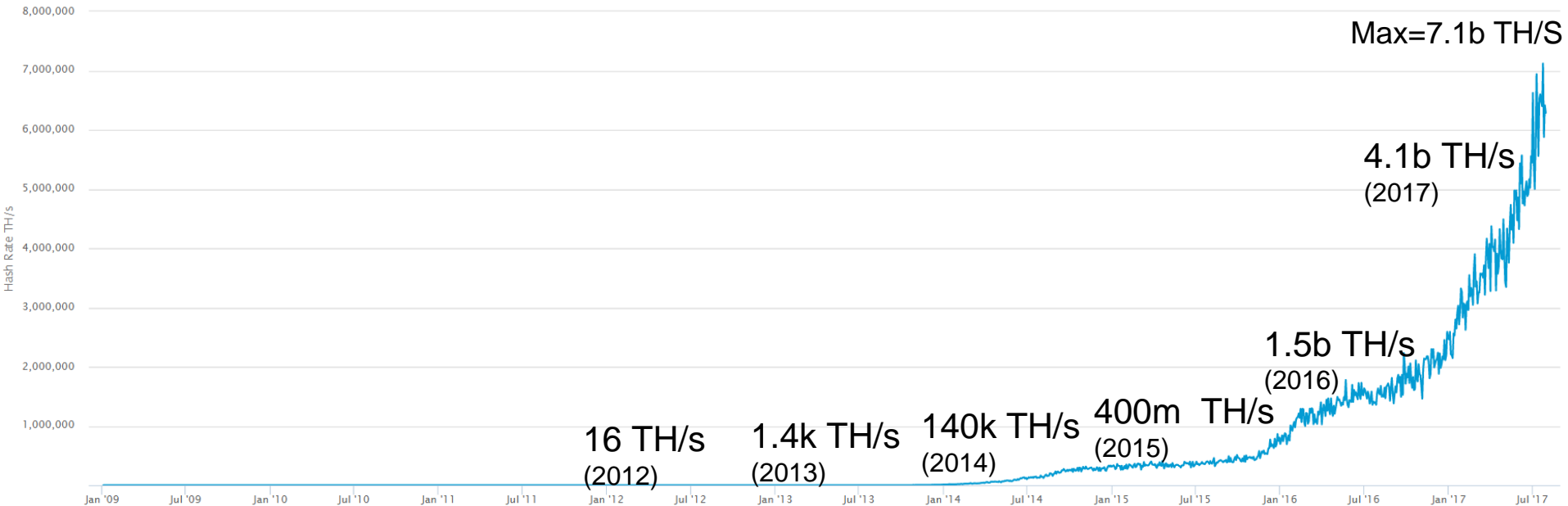
Bitcoin hashrate now exceeds 6 bln TH/s

Hash Rate

The estimated number of tera hashes per second (trillions of hashes per second) the Bitcoin network is performing.

Source: blockchain.info

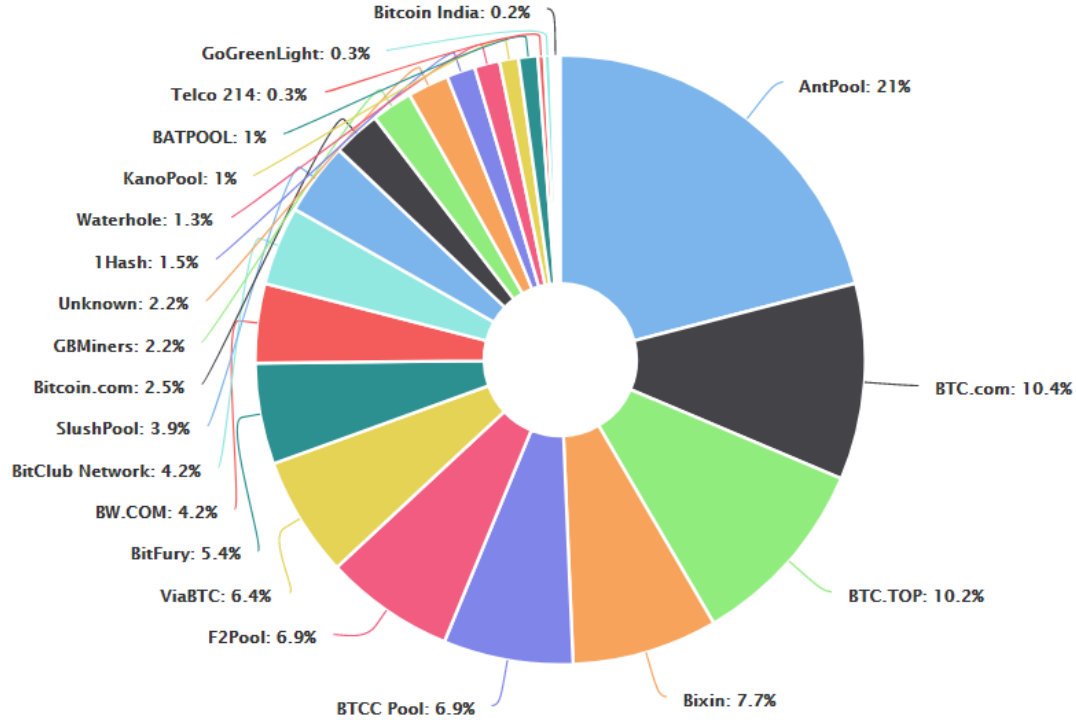
1 TH/s = 1'000'000'000'000 H/s



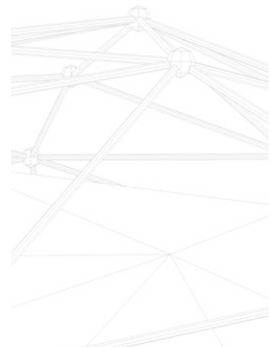
<https://blockchain.info/en/charts/hash-rate?timespan=all>

Hashrate distribution

...with Chinese pools dominate

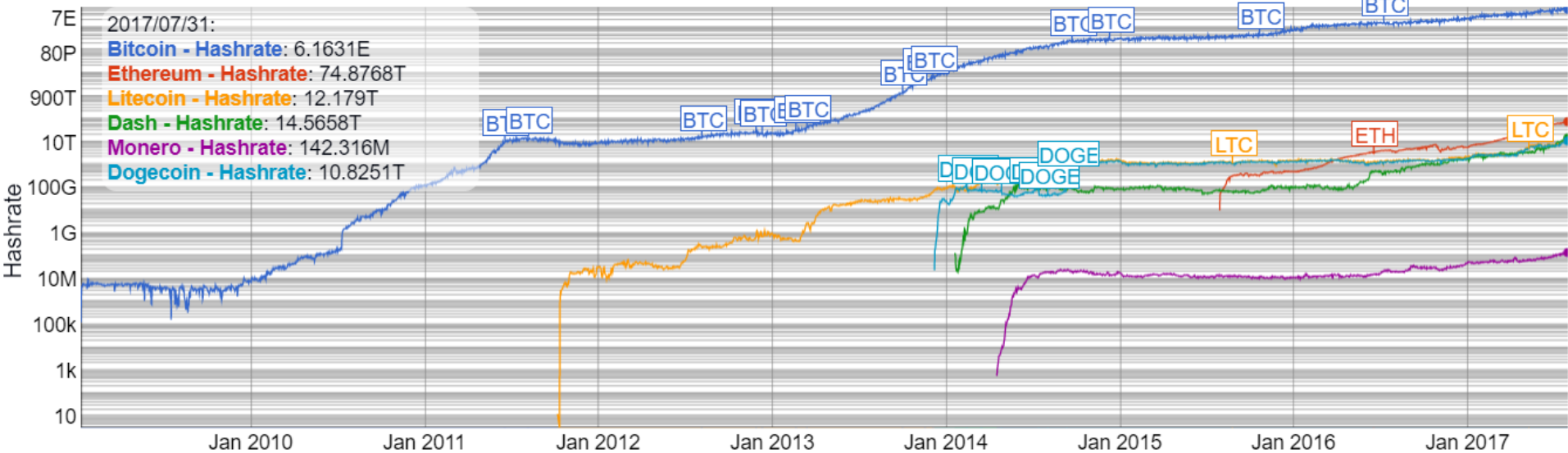


<https://blockchain.info/pools>



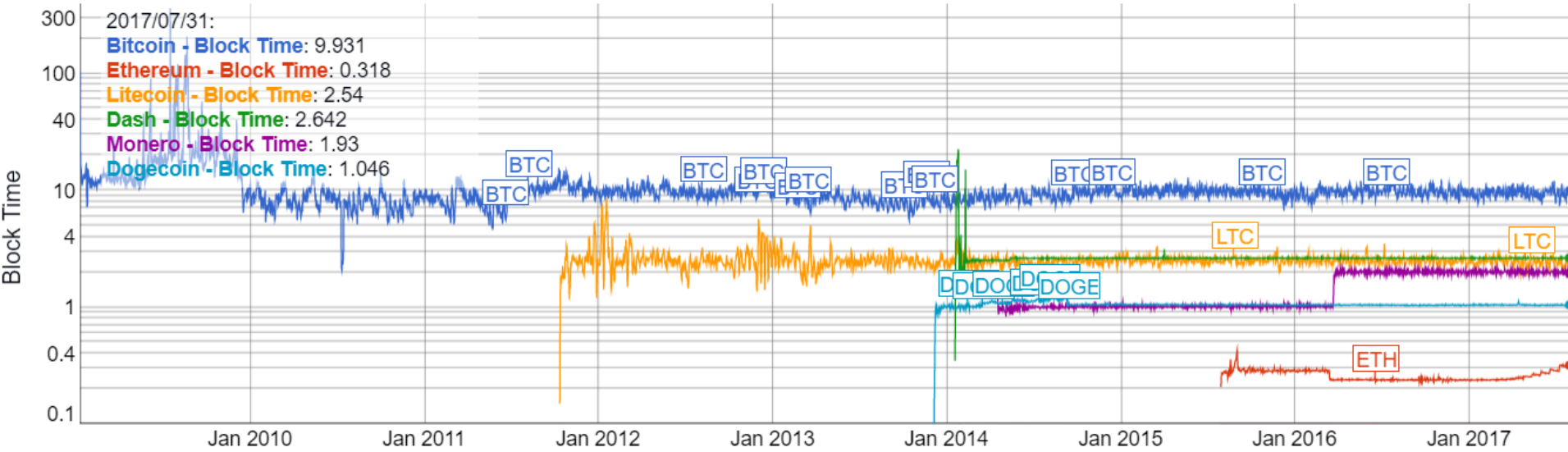
Hashrate

Hashrate linear in logscale => exponential growth



Block time

Bitcoin 10 min, Litecoin 2.5 min, Ethereum 20 sec



Nodes geography

GLOBAL BITCOIN NODES DISTRIBUTION

Reachable nodes as of Tue Aug 01 2017
04:33:03 GMT+0500 (Russia TZ 4 Standard Time).

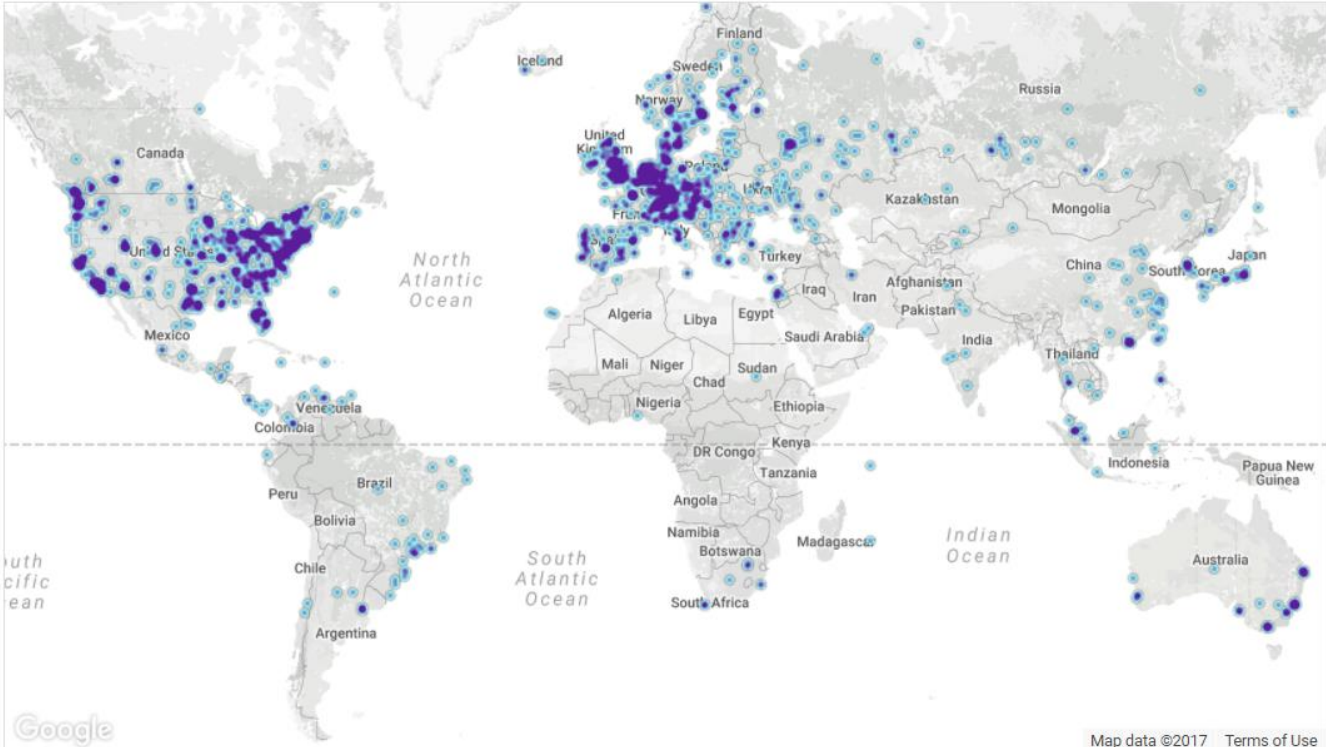
8715 NODES

24-hour charts »

Top 10 countries with their respective number of reachable nodes are as follow.

RANK	COUNTRY	NODES
1	United States	2583 (29.64%)
2	Germany	1537 (17.64%)
3	France	597 (6.85%)
4	Netherlands	465 (5.34%)
5	Canada	358 (4.11%)
6	United Kingdom	320 (3.67%)
7	Russian Federation	312 (3.58%)
8	n/a	293 (3.36%)
9	China	264 (3.03%)
10	Singapore	153 (1.76%)

More (91) »



Map shows concentration of reachable Bitcoin nodes found in countries around the world.

LIVE MAP

<https://bitnodes.21.co/>

Nodes

8614
Reachable nodes

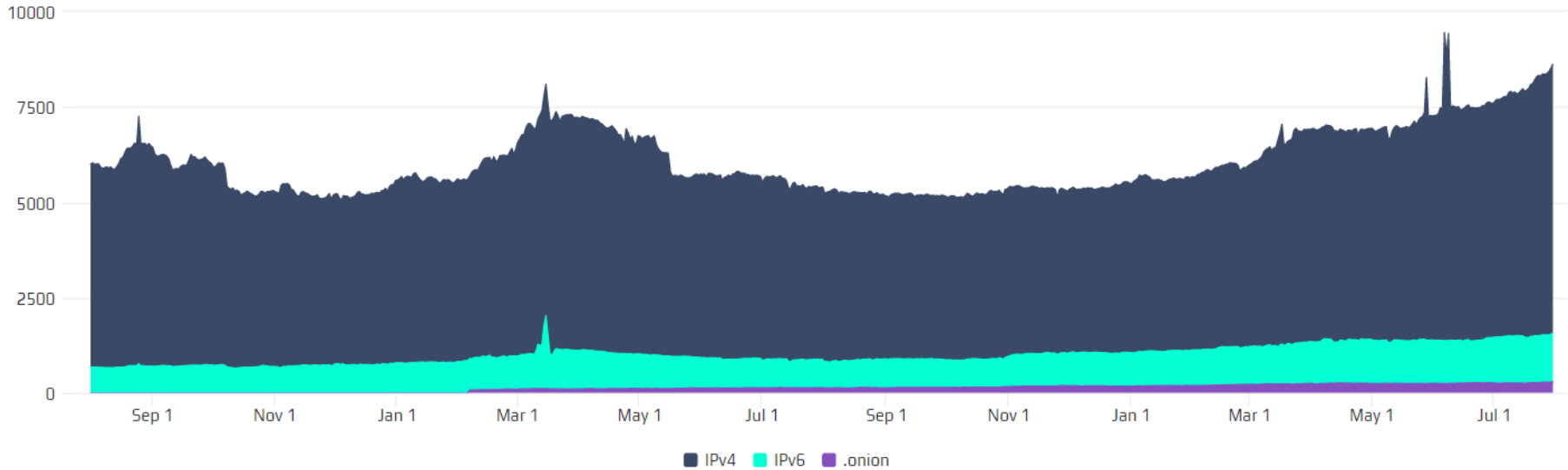
6058
Average

2617 ▲ 43.64%
Since 730 days ago

NODES
Chart shows the number of reachable nodes during the last 730 days. Individual series can be enabled or disabled from the legend to view the chart for specific networks.

24h 90d 1y 2y

Lo 5053 Hi 9451 Avg 6058 Last 8614 nodes



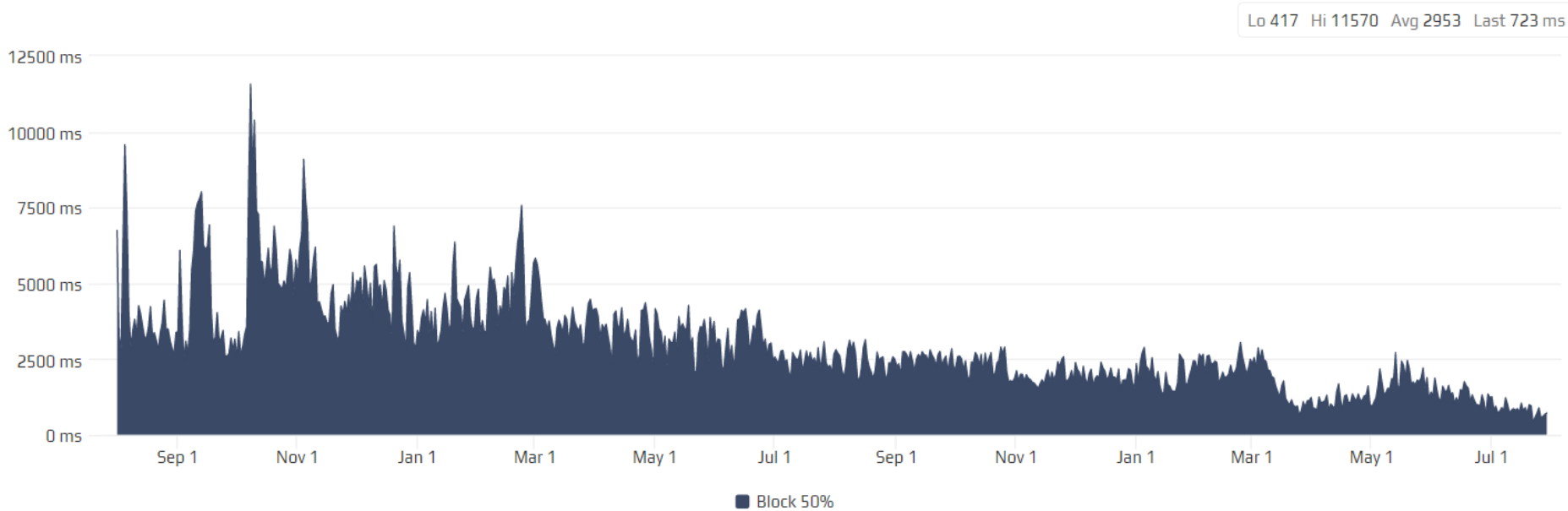
<https://bitnodes.21.co/>



Blocks propagation

BLOCKS PROPAGATION

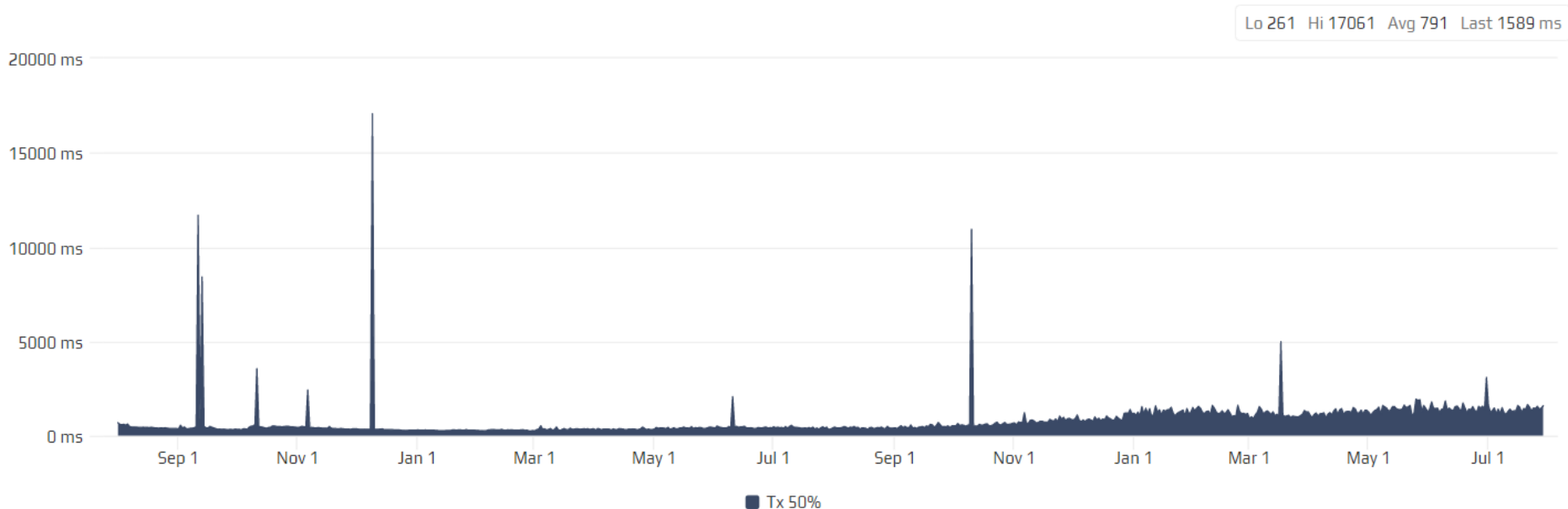
Chart shows propagation time in milliseconds for blocks during the last 730 days. Block 50% denotes 50% of the inv messages for the daily blocks were observed within the given time from the first 1000 nodes. Timestamp for an inv message is based on the time when the kernel first saw the packet containing the inv message. The aggregated data does not include inv messages that were observed 1 hour after the first inv message for the same block.



Transactions propagation

TRANSACTIONS PROPAGATION

Chart shows propagation time in milliseconds for transactions during the last 730 days. Tx 50% denotes 50% of the inv messages for all transactions in the daily blocks were observed within the given time from the first 1000 nodes. Timestamp for an inv message is based on the time when the kernel first saw the packet containing the inv message. The aggregated data does not include inv messages that were observed 1 hour after the first inv message for the same transaction.



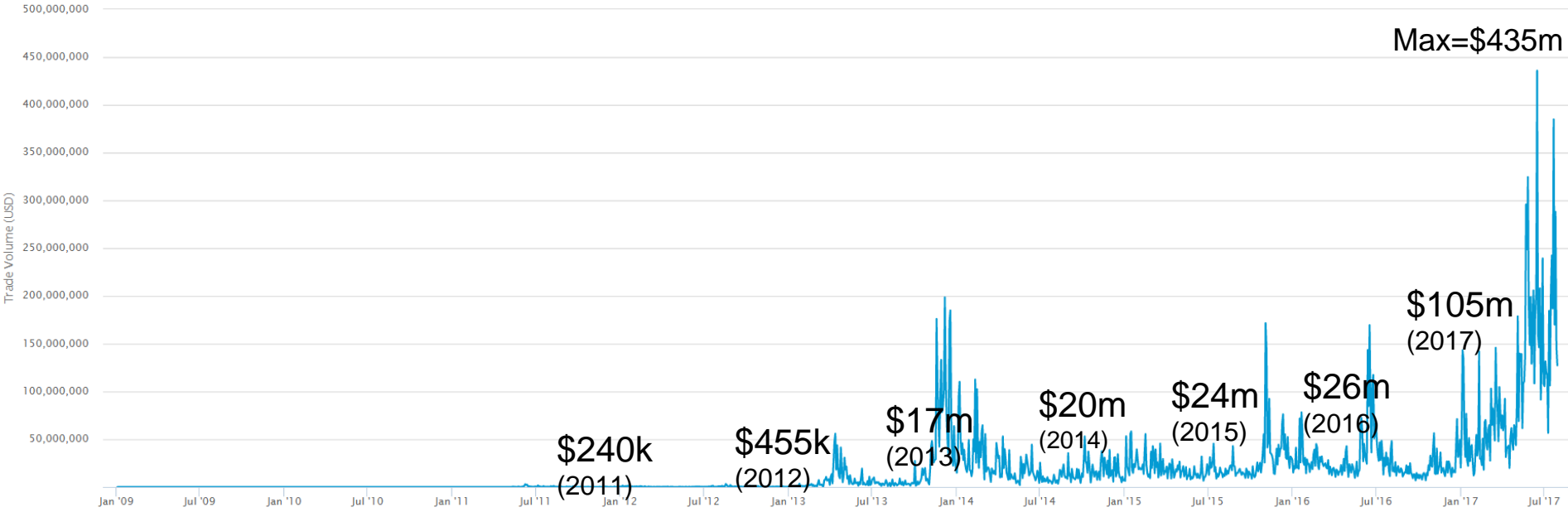
Bitcoin market volume

Traded value has soared

USD Exchange Trade Volume

The total USD value of trading volume on major bitcoin exchanges.

Source: blockchain.info

















<https://blockchain.info/charts/trade-volume?timespan=all>

Digital assets

158 digital assets, \$4.8 bln market cap

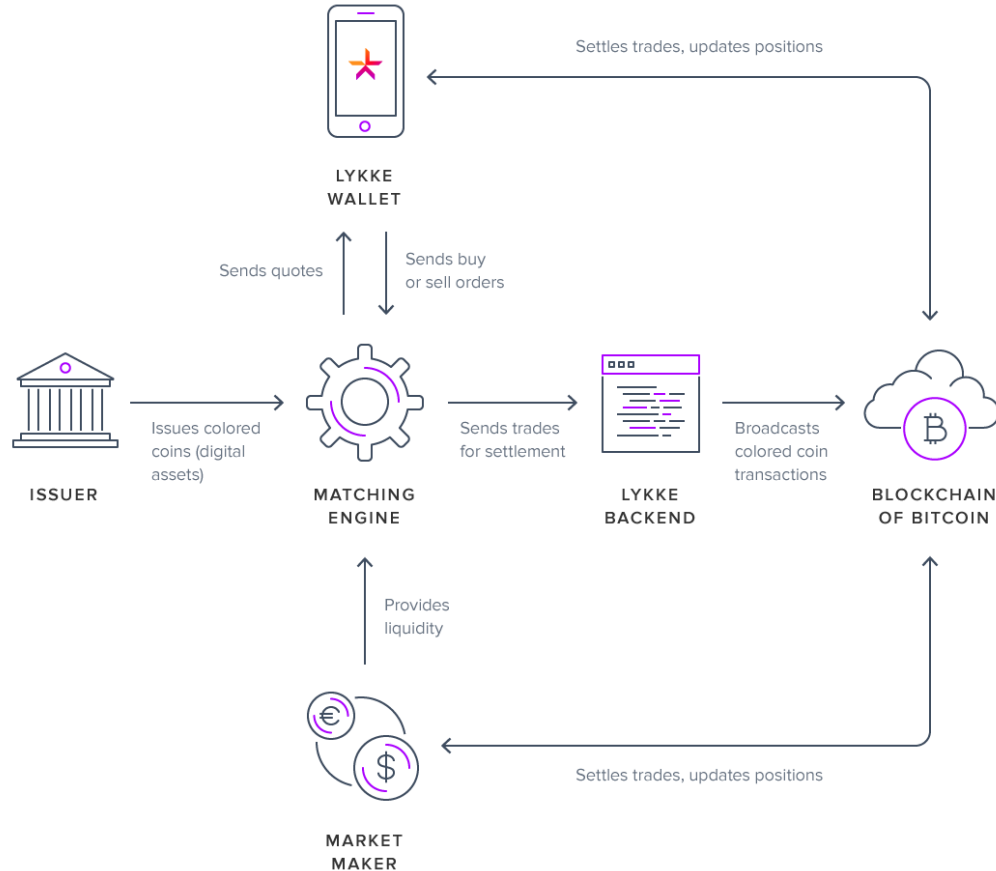
Platform	Assets	Market cap, \$	Top Assets
Ethereum	82	3,971,320,133	EOS, Qtum, Iconomi, Gnosis, Golem, Status, Augur, DigixDAO, BAT, Bancor, TenX, FirstBlood, Civic, Aragon, SingularDTV, Storj, Humaniq, SONM
Omni	9	497,701,286	Tether, MaidSafeCoin, Synereo, Safe, Agoras
Waves	15	156,397,372	MobileGo, CoEval, Bankcoin, Incent, ZrCoin
Nxt	14	142,281,326	Ardor, SuperNET, Jinn, Nautilus
Counterparty	10	50,082,925	Databits, Pepe cash, BitCrystals, NVO
BitShares	13	32,251,320	bitCNY, OBITS, Bitland, OpenLedger, BlockPay
NEM	1	16,068,933	EcoBit
Ubiq	2	5,297,917	APX, Qwark
NuBits	1	1,856,331	NuShares
Ethereum Classic	1	1,459,100	InPay
Burst	9	821,601	Casino, MTGaming, Qubick

▲#	Name	Platform	Market Cap	Price	Circulating Supply	Volume (24h)	% 1h	% 24h	% 7d
1	 EOS	Ethereum	\$445,147,635	\$1.76	253,638,150	\$30,140,200	0.95%	-0.69%	-5.82%
2	 Qtum	Ethereum	\$368,361,780	\$6.24	59,000,000	\$13,403,300	2.21%	13.00%	-13.31%
3	 Tether	Omni	\$320,252,041	\$1.00	319,501,213	\$75,804,500	0.13%	0.11%	0.73%
4	 Veritaseum	Ethereum	\$316,478,543	\$157.74	2,006,279	\$877,372	5.54%	12.73%	-18.61%
5	 Iconomi	Ethereum	\$274,541,668	\$3.16	86,900,350	\$2,356,350	2.54%	3.80%	-18.22%
6	 Gnosis	Ethereum	\$212,408,239	\$192.30	1,104,590	\$594,872	-2.29%	4.96%	-14.30%
7	 Golem	Ethereum	\$194,979,470	\$0.234060	833,032,000	\$1,956,940	1.65%	2.38%	-20.52%
8	 Status	Ethereum	\$189,059,116	\$0.054476	3,470,483,788	\$17,714,500	2.15%	8.04%	-27.46%
9	 Augur	Ethereum	\$185,040,900	\$16.82	11,000,000	\$1,485,550	0.73%	-1.97%	-21.97%
10	 MaidSafeCoin	Omni	\$127,412,964	\$0.281543	452,552,412	\$2,274,390	-2.55%	-7.58%	-25.12%
11	 DigixDAO	Ethereum	\$125,810,400	\$62.91	2,000,000	\$211,442	0.29%	2.66%	-1.15%
12	 Populous	Ethereum	\$124,841,226	\$3.37	37,004,027	\$907,526	4.64%	19.19%	39.53%
13	 OmiseGo	Ethereum	\$121,693,573	\$1.24	98,312,024	\$2,250,070	1.49%	2.44%	-16.70%
14	 MCAP	Ethereum	\$116,193,881	\$2.19	53,004,772	\$451,610	-0.44%	0.21%	-3.46%

Exchange design choices

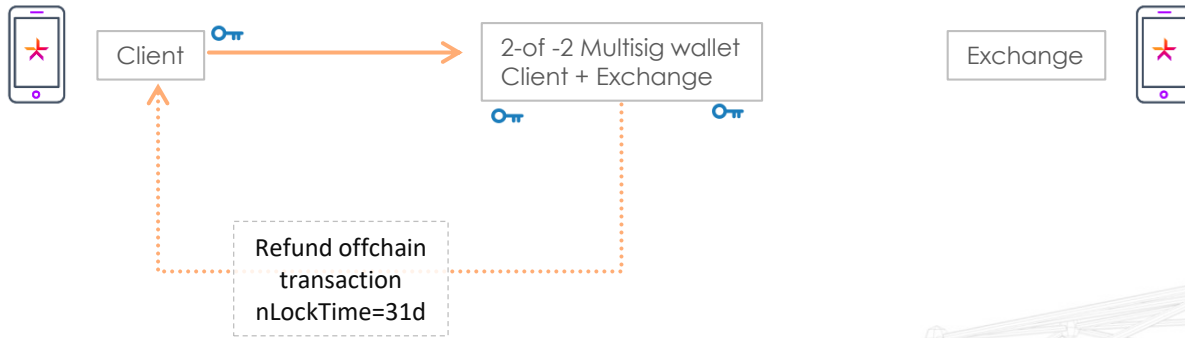
	Centralized	Decentralized	Semi-Centralized
Matching engine	Centralized	Distributed over the network	Centralized
Speed/Throughput	High	Very low	High
Last look	No	Yes	No
Asset ownership	Trusted	Direct ownership	Direct ownership
Custodian risk	Risk of hotwallet / coldwallet security	No	No
Private key management	Exchange side	Client side	Client side
Address for holding client's money	Hotwallet	Private wallet	Multisignature address
Settlement costs	Low	High	Medium
Settlement	Cashin/Cashouts only	Orders/trades	Offchain settlement
Integration efforts	Low	High	High
Blockchain integration	CashIns/Cashouts/Hotwallet	Fully integrated	Fully integrated

Lykke Exchange architecture



MultiSig wallets

Trading wallets multisig: 2-of-2 "permissioned-over-permissionless"
Exchange doesn't take custody of the assets



Onchain Settlement

Onchain atomic swap transactions: "delivery vs. payment"

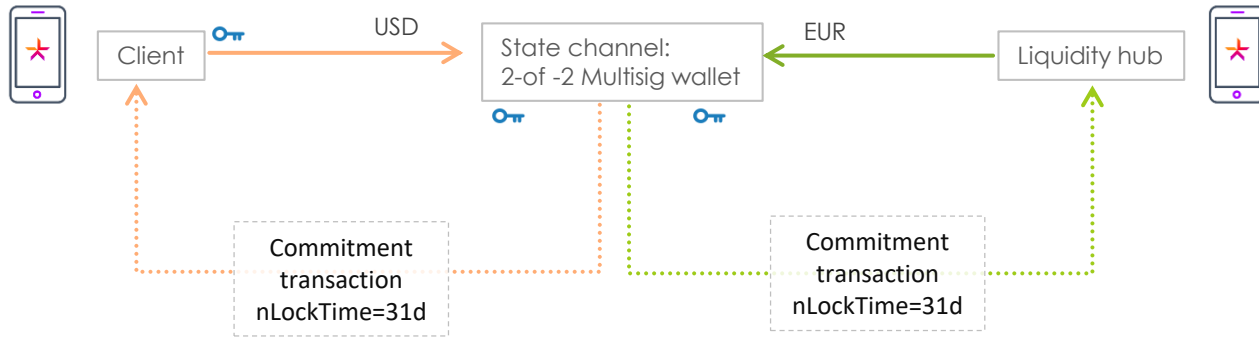


Swap has to have 2 signatures: buyer and seller



Offchain Settlement

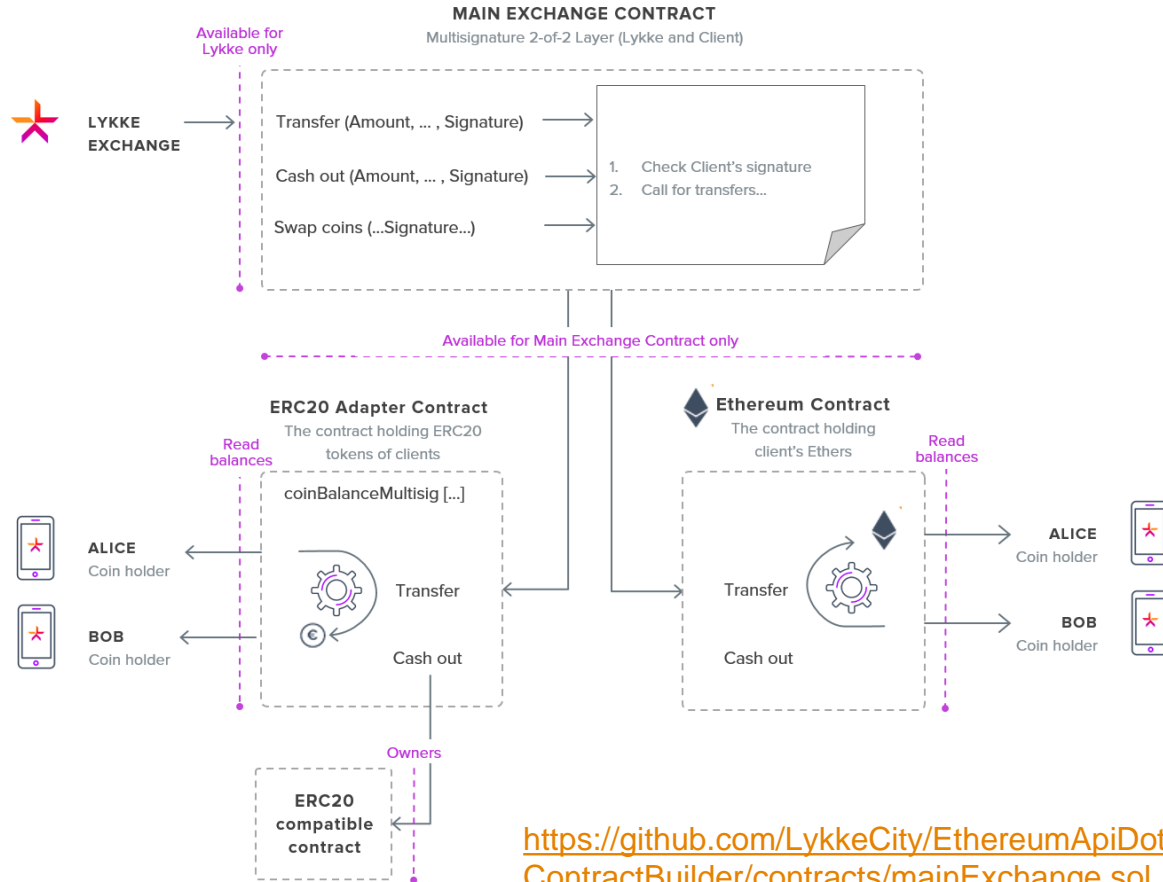
Channel is opened as 2-of-2 multisig wallets.
Clients and liquidity hub deposit collateral.



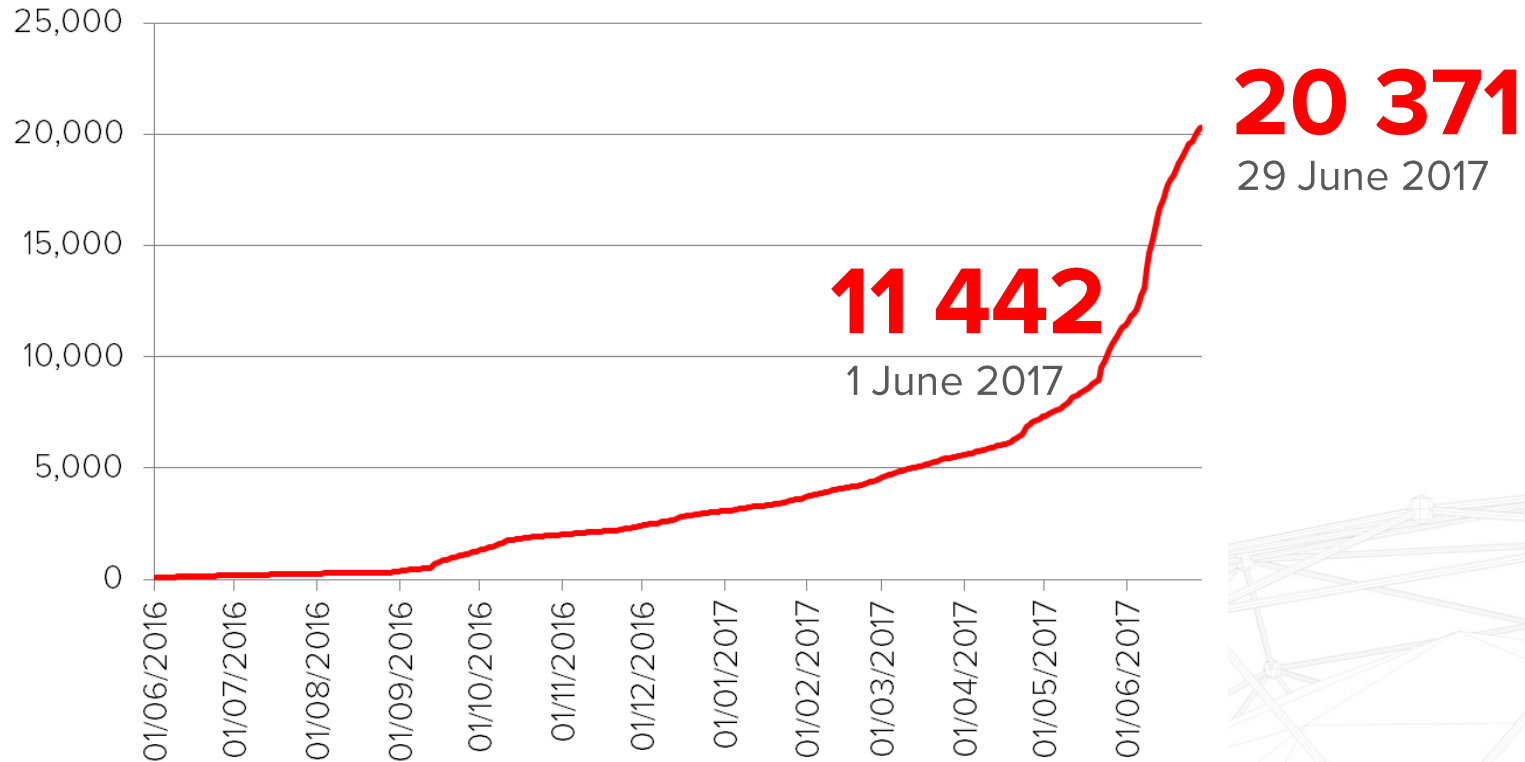
When trade occurs commitment transaction is signed that has the new balance.

Channel is closed by broadcasting the latest commitment transaction.

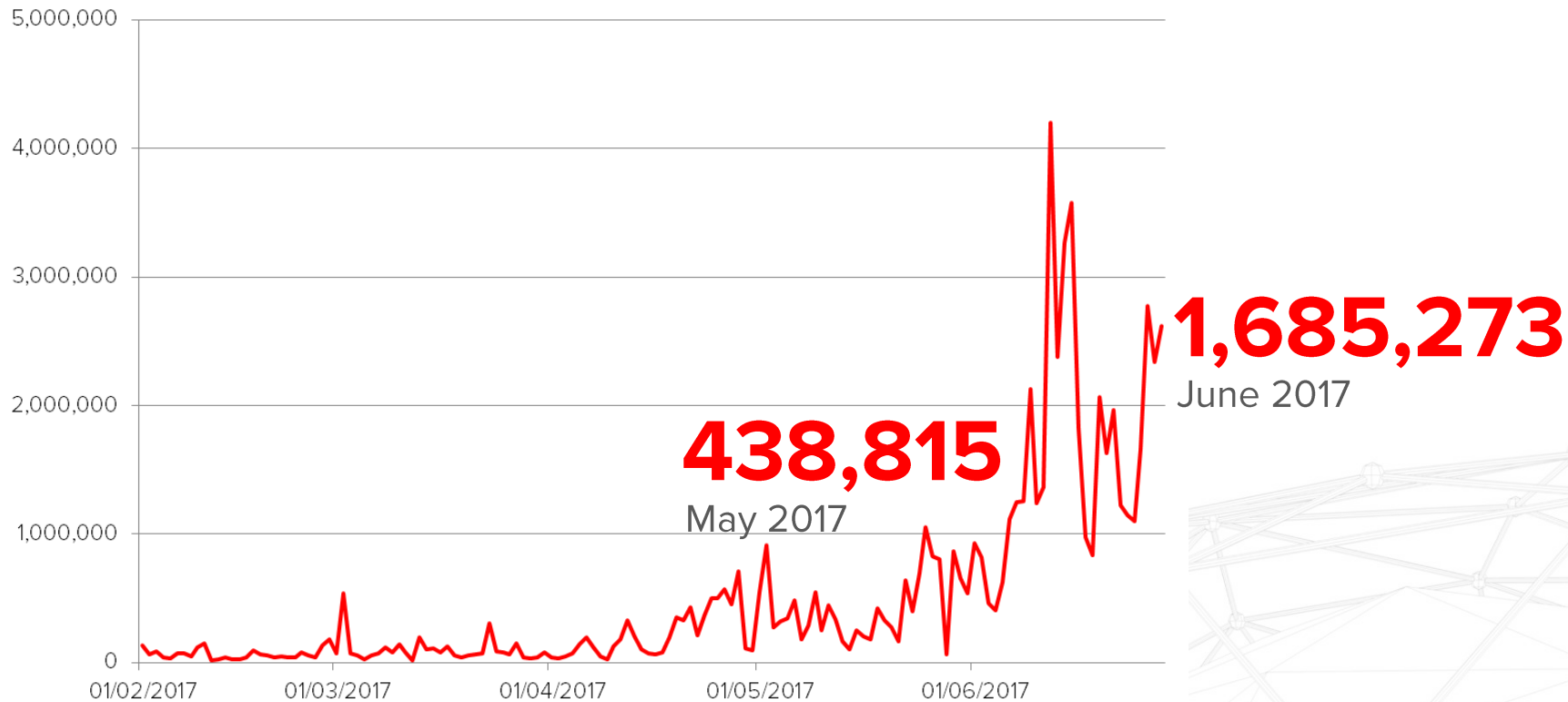
Ethereum Settlement



Accounts opened



Daily volume, USD



June Volume Breakdown

\$47,253,664 volume traded

21'176 trades by **3'904** users

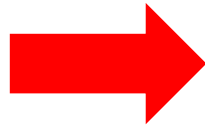
5.3 trades/user **\$2'230** avg trade size

Top **20%** traders do **90%** of the volume



June Volume Breakdown

Asset	UsdVol	Trades	%
BTC	13,101,596	4944	27.7%
LKK	10,284,139	3065	21.8%
CHF	6,280,186	2892	13.3%
USD	5,964,968	4887	12.6%
ETH	5,772,313	2105	12.2%
EUR	2,732,131	1686	5.8%
LKK1Y	1,537,883	496	3.3%
GBP	456,544	232	1.0%
TIME	438,476	396	0.9%
SLR	313,211	296	0.7%
HCP	161,073	90	0.3%
JPY	144,100	51	0.3%
MXN	24,824	1	0.1%
XAG	23,344	11	0.0%



Asset	UsdVol	Trades	%
LKK	15,881,530.58	7973	33.6%
ETH	7,374,601.29	3954	15.6%
USD	6,100,985.85	1361	12.9%
BTC	5,774,881.75	3477	12.2%
CHF	5,648,685.64	1414	12.0%
EUR	3,092,646.91	660	6.5%
LKK1Y	1,772,448.87	958	3.8%
GBP	581,910.78	138	1.2%
TIME	393,536.88	472	0.8%
SLR	287,571.72	492	0.6%
HCP	144,188.49	176	0.3%
JPY	139,751.27	52	0.3%
XAG	37,189.90	13	0.1%
XAU	16,562.83	11	0.0%