

Blockchain Technology Explained

A blockchain (distributed ledger) is an accounting ledger (an account of who owns what) running on a distributed network, operated by cryptographic protocols, without any centralized control. Blockchain is the protocol upon which applications such as Bitcoin run (Bitcoin is a cryptocurrency or digital payment system; a decentralized version of Paypal). Just as SMTP is an Internet protocol for sending email, blockchain is an Internet protocol for transferring money (assets, property), instantiating contractual relationships and voting, and confirming ID. The initial version of the Internet did not include payments or privacy functionality, and blockchain provides an update for this. With blockchain, simple networks (transferring information) become smart networks (confirming the authenticity of and transferring value). A blockchain is a chain of linked transaction blocks that is immutable and tamper-proof. The implication is that we can finally digitize all economic and legal-governance affairs for the Internet era, with the further implication that less institutional footprint is needed to manage the friction of human interaction.

Currency is merely the first application in the bigger blockchain technology revolution that is updating Internet networks for the digital age of transferring unique items of value. The four classes of blockchain applications are: 1) money, payments, financial instruments; 2) property (auto, home titles); 3) contracts (business registrations, partnership agreements, wills, patents); and 4) identity credentials (diploma, visa, passport, driver's license, ID). There are two kinds of blockchains, public (Bitcoin, Ethereum, Monero, Zcash) and private (industry consortia like R3 Corda, IBM Hyperledger, JP Morgan Quorum, SweetBridge supply chain blockchain settlement and collateralization).

Decentralized peer-to-peer network: The entire operation of a blockchain is coordinated by the software protocol running on the network nodes. The “dumb” nodes merely conduct operations as specified by the software. One network activity is transaction hosting: there are ~11,000 voluntary peer-to-peer nodes hosting the transaction ledger. Another network activity is mining, confirming and recording new transactions for a lucrative reward. The dramatic implication of p2p networks is that the nodes can provide not just network operation services for each other, but application level services too, such as news-hosting, and banking. Updates to the software occur in vociferous and lengthy worldwide debates among the five main constituencies (developers, miners, exchanges, wallets, and merchants) about which proposed changes to the open-source software will be taken up via a soft fork (backward-compatible) or a hard fork.

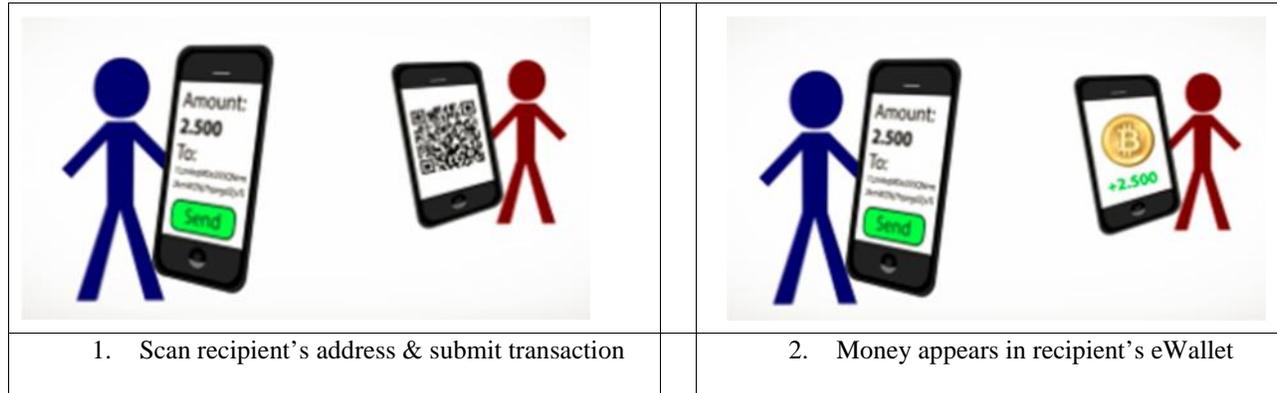
Resources

101 Resources: “Introduction to Bitcoin” Andreas Antonopoulos (YouTube); *Blockchain for Dummies*; Purdue Internet of Value crypto-seminar (Mon 2-3 pm HAAS 111)

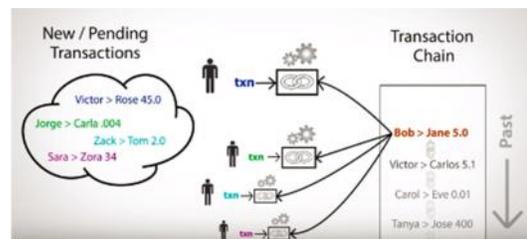
Conceptual Resource: Swan, M. 2015. *Blockchain: Blueprint for a New Economy*

Business Resource: Morabito, Vincenzo. (2017). *Business Innovation Through Blockchain: The B3 Perspective*. Springer.

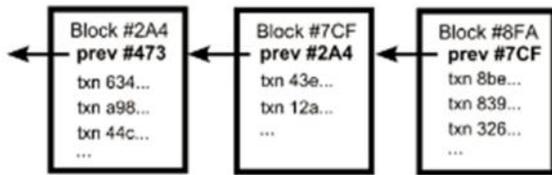
Figure 1: How does Bitcoin work?



3. Wallet has keys not money



4. Transactions mined in cloud "mem pool"



5. Transaction blocks chained together

Ledger

account number	balance
1G8bnejbetY...	12.5
1K7A6wsyxj6...	323
Carol 16pJcrGi51nr...	6.0 +5.0
Bob 1MvbjHicuJr...	10.2 -5.0
1G4HyHp1oa...	100
17UP3moev2...	.00000001
1Eeq4FM2Ts...	45

Bob (stick figure) and Carol (stick figure with Bitcoin icon) are shown below the ledger.

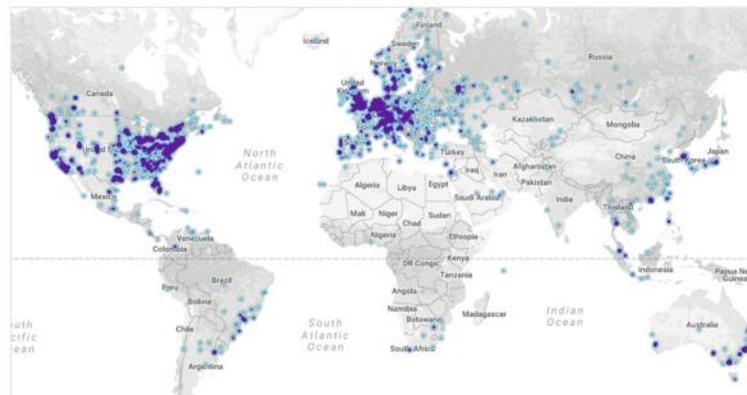
6. New ledger balances updated

GLOBAL BITCOIN NODES DISTRIBUTION
 Reachable nodes as of Mon Nov 13 2017
 20:53:50 GMT-0500 (Eastern Standard Time).

10947 NODES
 24-hour charts »

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

RANK	COUNTRY	NODES
1	United States	3153 (28.80%)
2	Germany	1804 (16.48%)
3	China	745 (6.81%)
4	France	709 (6.48%)
5	Netherlands	502 (4.59%)
6	Canada	439 (4.01%)
7	United Kingdom	408 (3.73%)
8	n/a	391 (3.57%)
9	Russian Federation	344 (3.14%)
10	Singapore	230 (2.10%)



7. Worldwide peer nodes update their copy of the transaction ledger with the new block

Image credits: <https://www.youtube.com/watch?v=t5JGQXCTe3c>, <https://bitnodes.earn.com/>