

UNDERSTANDING BLOCKCHAIN AND WHETHER IT'S THE ANSWER TO INCREASING TRANSPARENCY AND VERIFICATION WITHIN SUPPLY CHAIN MANAGEMENT

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References to external sources

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What?is Blockchain technology.

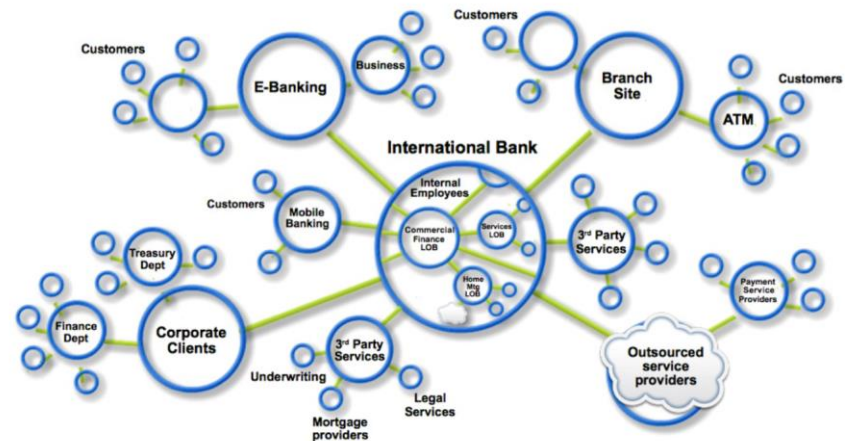
Why?is it relevant for business?

When?will it impact companies at large?

Business Networks, Markets & Wealth

- Business Networks benefit from connectivity
 - Connected customers, suppliers, banks, partners
 - Cross geography & regulatory boundary
- Wealth is generated by the flow of goods & services across business networks

- Markets are central to this process:
 - Public (fruit market, car auction), or
 - Private (supply chain financing, bonds)



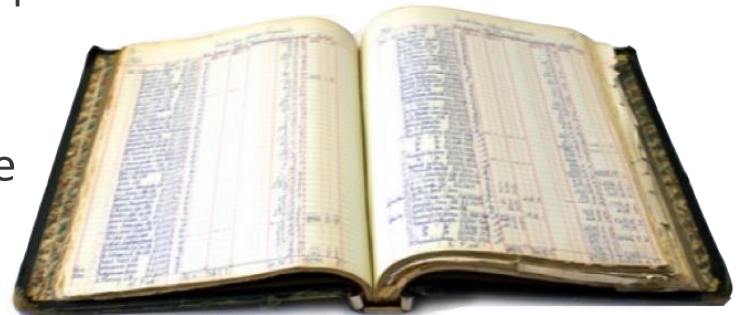
➤ Transferring Assets, Building Value

- Anything that is capable of being owned or controlled to produce value is an asset
- Two fundamental types of assets
 - Tangible, e.g. a house
 - Intangible, e.g. a mortgage, digital assets (music, video, crypto)
- Intangible assets subdivide
 - Financial, e.g. bond
 - Intellectual, e.g. patents
 - Digital, e.g. music
- Cash is also an asset
 - Has property of anonymity



› Ledgers are Important since the Beginning of Time

- Ledger is THE system of record for a business to track “ownership”
 - Records asset transfer between participants
- Business will most likely have multiple ledgers for multiple business networks in which they participate
- “Ledger” defined -- The principal book (or computer file) for recording and totaling financial transactions by account type, with debits and credits in separate columns and a beginning monetary balance and ending monetary balance for each account



› Digital Ownership

- **Digital ownership** is the problem that blockchain is designed to solve. Some items are easily copied and shared—music, videos, articles and ebooks. The internet is full of digital copies of these things, both legal and illicit. The ownership of informational items like these is easy to track because the original item rarely, if ever, changes hands. We simply purchase (or are given) the right to view a copy of the original. That method of ownership doesn't work for all items though. Some items—currency, real estate, commodities and goods—can't be copied and those copies distributed. They can't be owned simultaneously by two parties, so record of ownership becomes both vital and difficult to track. As a simple example, when a person spends digital money (basically anything but cash or check), someone has to ensure that the money is actually transferred rather than copied. A blockchain code is designed to keep an instantaneous record of transactions, thereby ensuring that no two people can own the same thing at the same time.

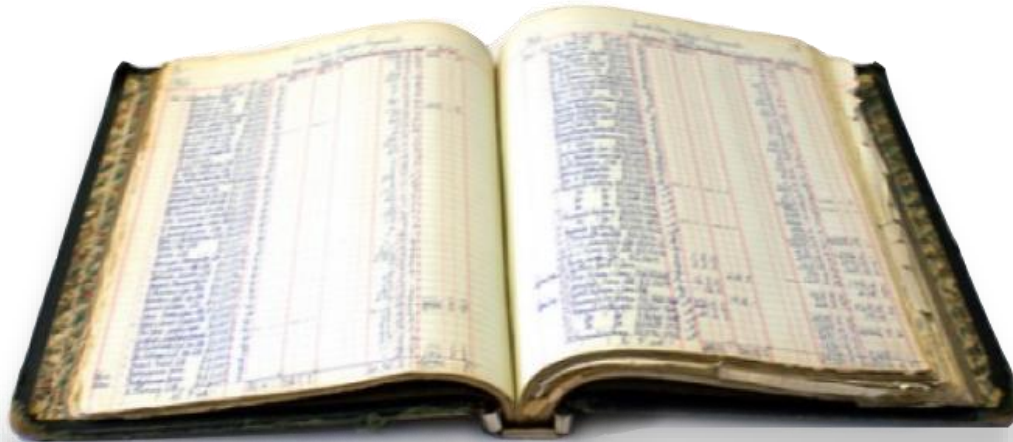
Participants, Transactions & Contracts

- Participants - members of a business network
 - Customer, supplier, government, regulator
 - Usually resides in an organization
 - Has specific identities and roles
- Transaction - an asset transfer
 - John gives a car to Anthony (simple)
- Contract - conditions for transaction to occur
 - If Anthony pays John money, then car passes from John to Anthony (simple)
 - If car won't start, funds do not pass to John (as decided by third-party arbitrator) (more complex)



➤ Introducing Blockchain

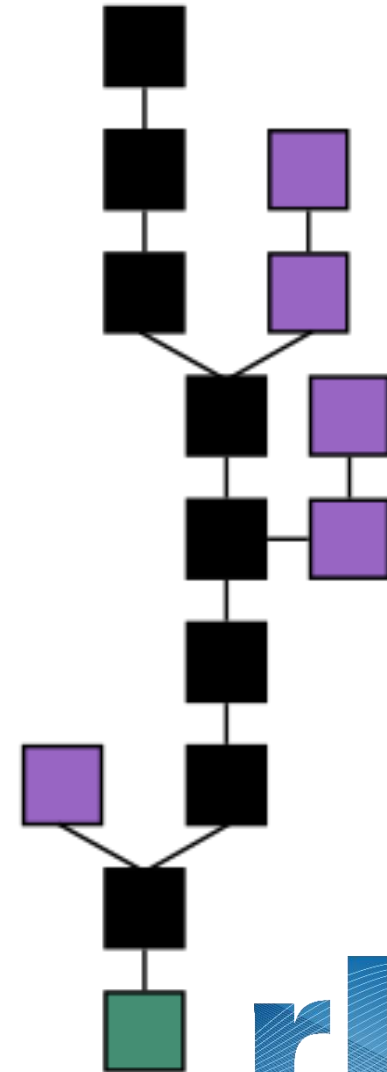
A shared ledger technology allowing any participant in the business network to see THE system of record (ledger)



Blockchain Definition

A continuously growing list of [records](#), called *blocks*, which are linked and secured using [cryptography](#). Each block typically contains a [hash](#) pointer as a link to a previous block, a [timestamp](#) and transaction data. By design, blockchains are inherently resistant to modification of the data. The [Harvard Business Review](#) describes it as "an open, [distributed ledger](#) that can record transactions between two or more parties efficiently and in a verifiable and permanent way."

Blockchain formation. The main chain (black) consists of the longest series of blocks from the genesis block (green) to the current block. Orphan blocks (purple) exist outside of the main chain.

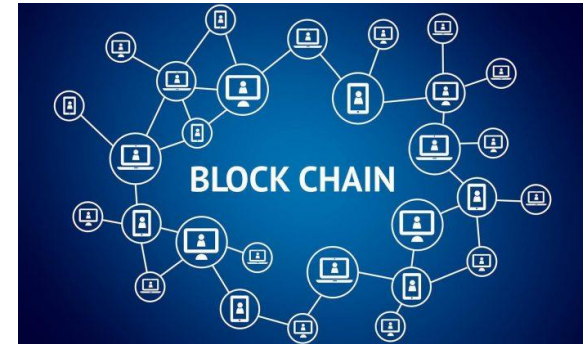


› Blockchain is not “Cryptocurrency”

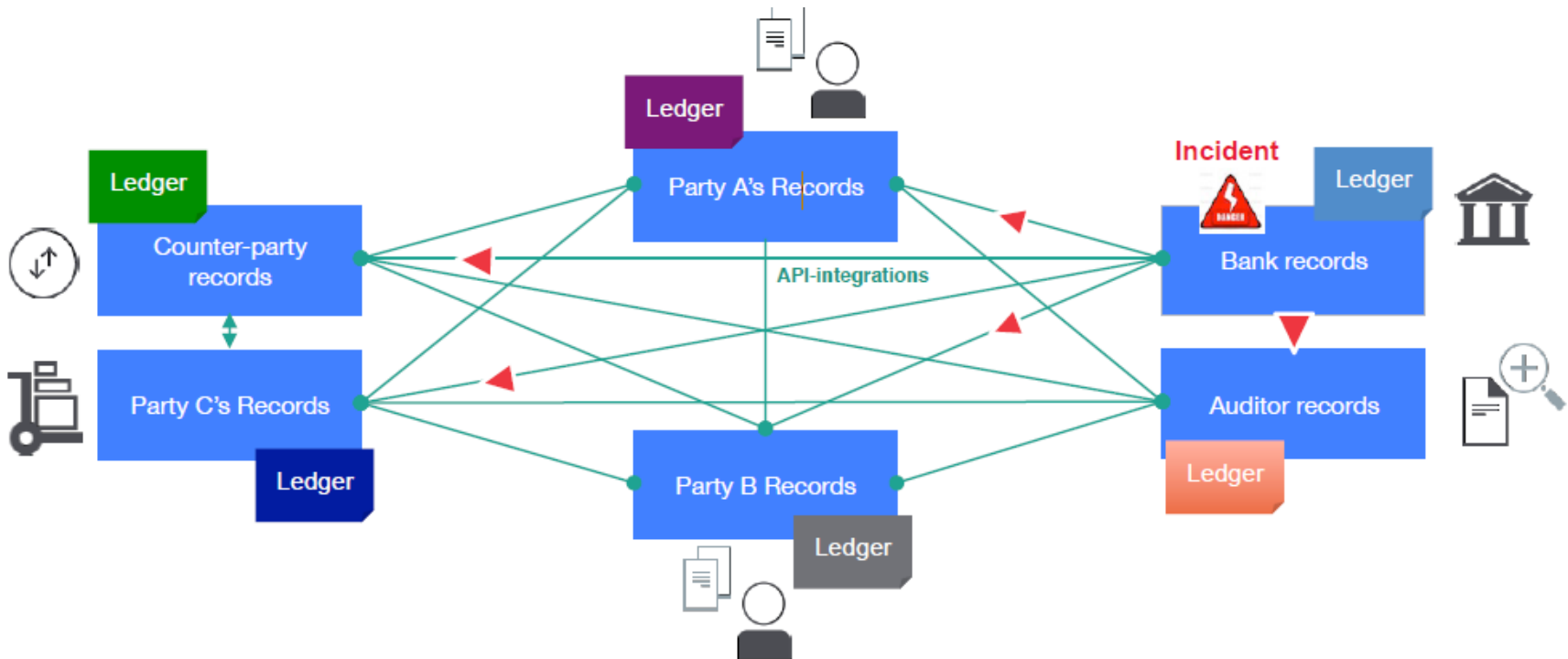
Cryptocurrency is only one application of the blockchain protocol (coding) – more on that later

› Three levels of Blockchain

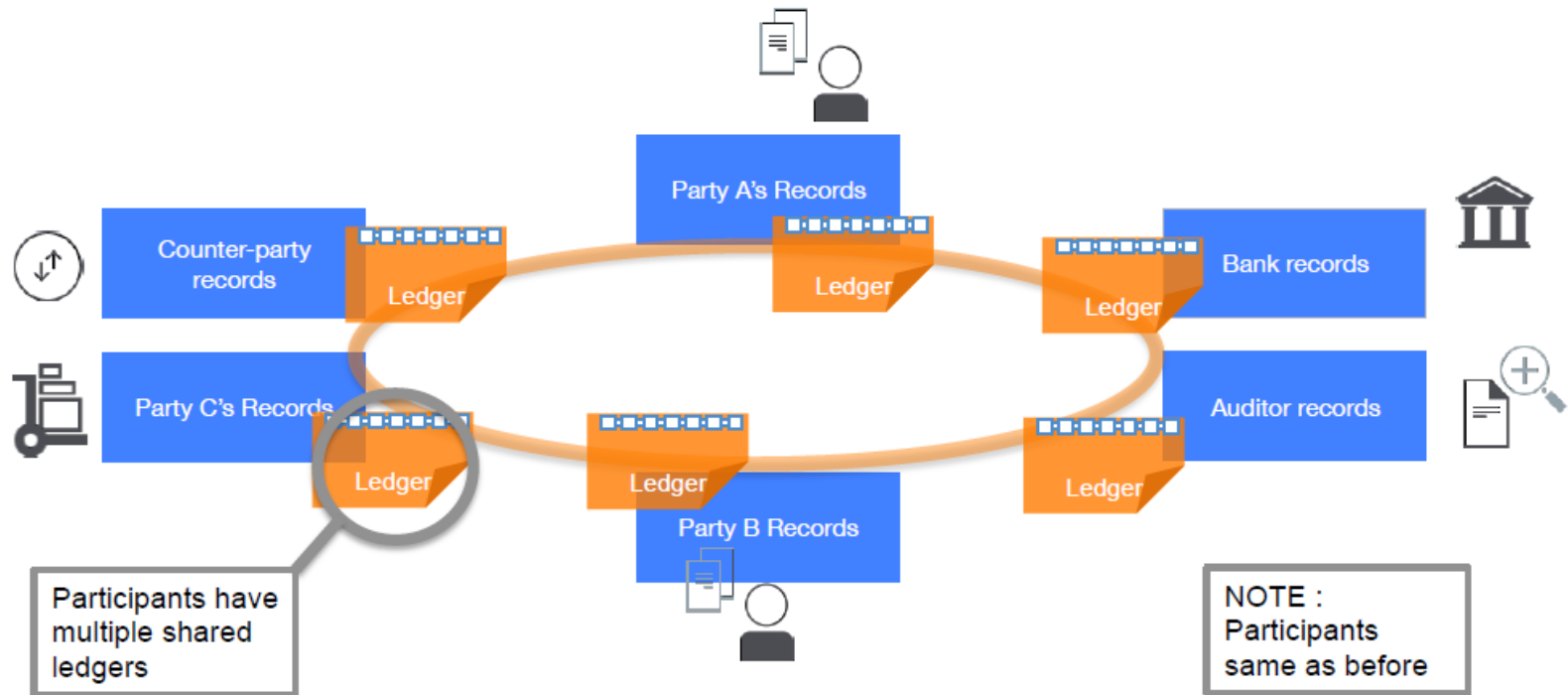
- Private (i.e. Multichain, Hydrachain)
 - Centralized to one organization
 - Accessible by permissioned parties
 - Tighter rules for transactions specific to organization
- Consortium (i.e. Hyperledger (open source – Linux) Sawtooth (Intel) and Fabric (IBM), Azure Enterprise, IBM Enterprise Blockchain)
 - Partially decentralized
 - Accessible only by permissioned parties
 - Scalable and fast transaction speed
 - Many projects are created with open source coding (like Linux model)
- Public (i.e. Bitcoin, Litecoin, Ethereum, Dash, Peercoin, Ripple)
 - Fully decentralized
 - Publicly accessible
 - Typically runs smart contracts and tracks ownership of assets well



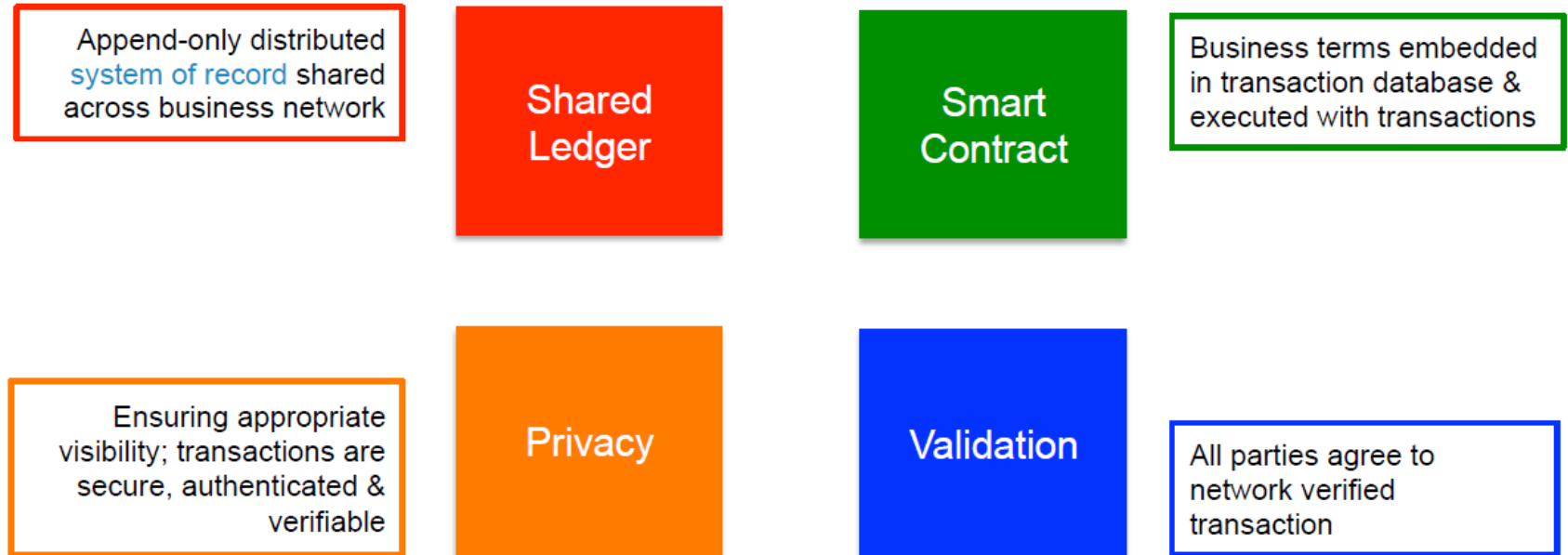
➤ **Current Problem** - Difficult to monitor asset ownership and transfers in a trusted business network = **Inefficient, expensive, vulnerable**



➤ **Solution of Future** – a permissioned, replicated, shared ledger (i.e. Blockchain) = **Consensus, provenance, immutability, finality**



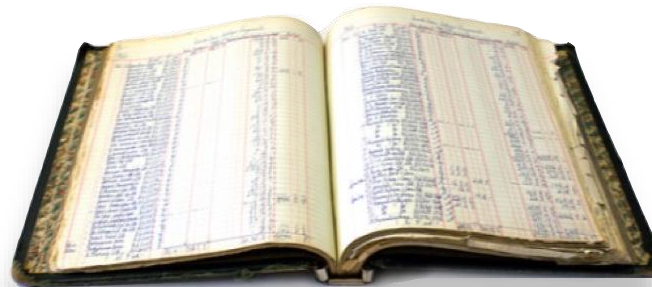
» Blockchain for Business



Broader participation, lower cost, increased efficiency

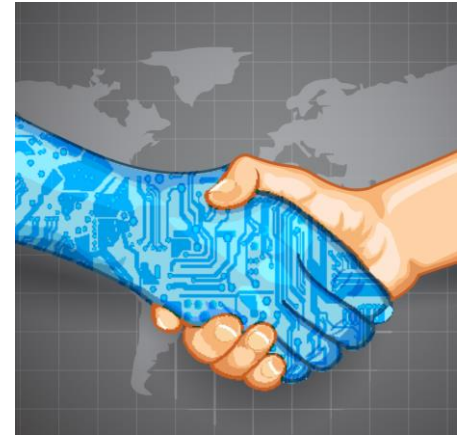
› Shared Ledger

- Records all transactions across business network
- Shared between participants
- Participants have own copy through replication (nodes)
- Can be permissioned, so participants see only appropriate transactions
- THE shared system of record



› Smart Contract

- Business rules implied by the contract . .
- . . embedded in the Blockchain code & executed with the transaction
- Verifiable, signed
- Encoded in programming language
- Example:
 - Defines contractual conditions under which digital corporate Bond transfer would occur



» Privacy

- Ledger is shared, but participants require privacy
- Participants need:
 - Transactions to be private
 - Identity not linked to a transaction
- Transactions need to be authenticated
- Cryptography central to these processes



Validation

- Transaction verification & commitment
- When participants are anonymous
 - Commitment is expensive
 - *Bitcoin cryptographic mining* provides verification for anonymous participants but at significant computes cost (proof of work)
- When participants are known & trusted
 - Commitment possible at low cost
- Multiple alternatives
 - Proof of stake where fraudulent transactions cost validators (e.g. transaction bond)
 - Multi-signature (e.g. 3 out of 5 participants agree)
- Industrial Blockchain needs “pluggable” consensus (i.e. programming outside of the network)
 - Must meet and have standard authentication scheme to allow entry and interface into the network



➤ Blockchain Benefits to Companies/Corporations

Reduce costs and complexity



Trusted recordkeeping



Improve discoverability



Shared trusted processes



Use Example – Letter of Credit

What?

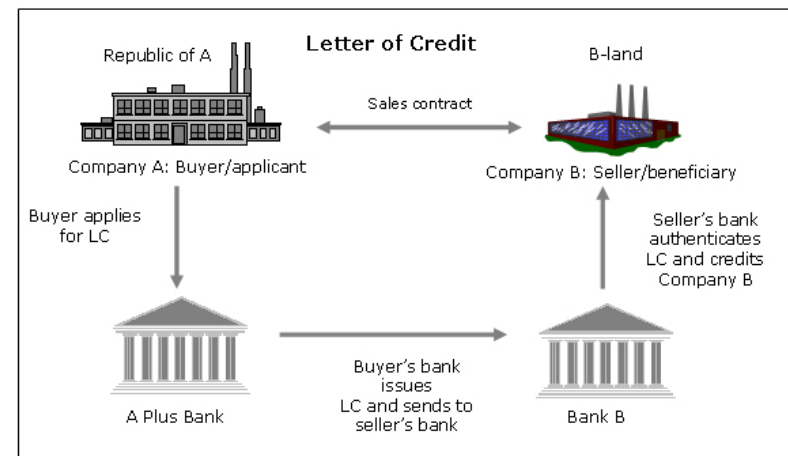
- Bank handling letters of credit wants to offer them to a wider range of clients, including startups
- Currently constrained by costs & the time to execute

How?

- Blockchain provides common ledger for letters of credit
- Allows bank and counter-parties to have the same validated record of transaction and fulfillment

Benefits

- Increased trust
- Increase speed of execution (less than 1 day)
- Vastly reduced cost



› Use Example – Corporate Debt

What?

Bank holding a corporate debt would like to:

- Pay vendors quickly for transactions validated by the client
- Allow the corporate client to see the payment is made
- Provide government with oversight of the process

How?

- Blockchain provides a common ledger for recording the corporate debt / bond
- Available to bank, corporate client, vendors & government

Benefits

- Speeds up vendor payments, bigger net discounts
- Eliminates risk and accelerates decision-making
- Owning bank can spread the cost across each market



› Use Example – Business to Business Contract

What?

- Buyer wants efficient way of converting a purchase order into validated, self-executing contract updated to reflect the status of the supply
- Agreement must be visible simultaneously to the buyer, the seller, banks, logistics partners and other stakeholders

How?

Blockchain provides a shared record of the contract status which is updated as the contract progresses

Available to all parties to the agreement, their banks and partners

Benefits

1. Increased efficiency and transparency across the supply chain
2. Risk management improved through the near real time update of all contracts

























› Use Example – Cryptocurrency

What?

- Digital asset used as a medium of exchange or a store-of-value
- Bitcoin (2009), described as “peer-to-peer electronic cash,” is first ever decentralized cryptocurrency using digital blockchain
- Bitcoin was preceded in concept by eCash/Digicash (c.1982), Hashcash (1997), b-money (1998) and bit gold (1998), but was first to address both the Byzantine Generals’ Problem and the double-spend problem
- Today over 1,900 cryptocurrencies trading globally OTC and on centralized exchanges with over \$200B in total market cap*

**(Source: CoinMarketCap.com)*

#	Name	Market Cap	Price	Volume (24h)	Circulating Supply	Change (24h)	Price Graph (7d)
1	 Bitcoin	\$111,535,726,540	\$6,464.04	\$4,378,688,214	17,254,800 BTC	-0.05%	
2	 Ethereum	\$22,096,416,695	\$217.02	\$1,675,301,909	101,815,655 ETH	-3.52%	
3	 XRP	\$11,633,449,849	\$0.293402	\$237,681,729	39,650,153,121 XRP *	-2.58%	
4	 Bitcoin Cash	\$8,665,127,014	\$499.84	\$380,664,416	17,335,888 BCH	-1.94%	
5	 EOS	\$4,601,232,192	\$5.08	\$677,935,489	906,245,118 EOS *	-0.12%	
6	 Stellar	\$3,882,558,373	\$0.206703	\$64,041,272	18,783,266,641 XLM *	3.59%	
7	 Litecoin	\$3,278,224,657	\$56.34	\$237,932,158	58,190,353 LTC	0.56%	
8	 Tether	\$2,767,392,679	\$1.00	\$2,918,267,317	2,756,421,736 USDT *	0.32%	
9	 Cardano	\$2,181,813,577	\$0.084152	\$46,090,358	25,927,070,538 ADA *	-2.71%	
10	 Monero	\$1,846,383,328	\$112.68	\$35,688,798	16,386,570 XMR	-0.61%	
11	 IOTA	\$1,596,501,055	\$0.574378	\$40,052,518	2,779,530,283 MIOTA *	-0.70%	

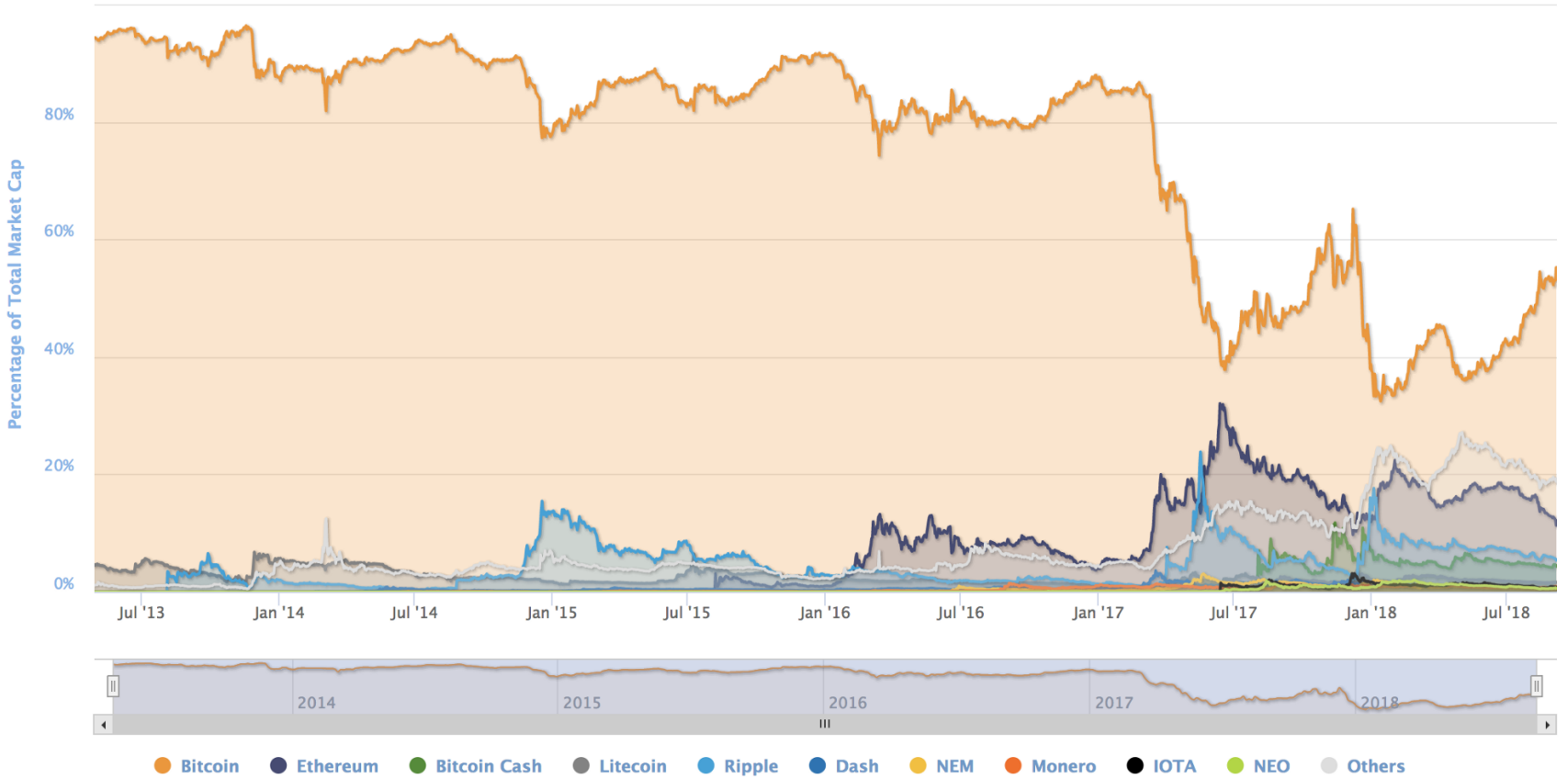
(Source: CoinMarketCap.com; 9/5/18)

Percentage of Total Market Capitalization (Dominance)

Overlapping Stacked

Zoom 1d 7d 1m 3m 1y YTD ALL

From Apr 28, 2013 To Sep 5, 2018



Use Example – Cryptocurrency

How?

HOW DO BITCOINS WORK?



Miners' create Bitcoins by using computers to solve mathematical functions. The same process also verifies previous transactions

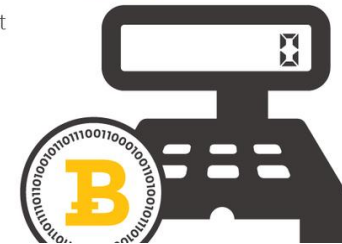


Bitcoin exchanges will trade between conventional currencies and Bitcoin, offering a way into the market for non-miners, as well as a way to cash out

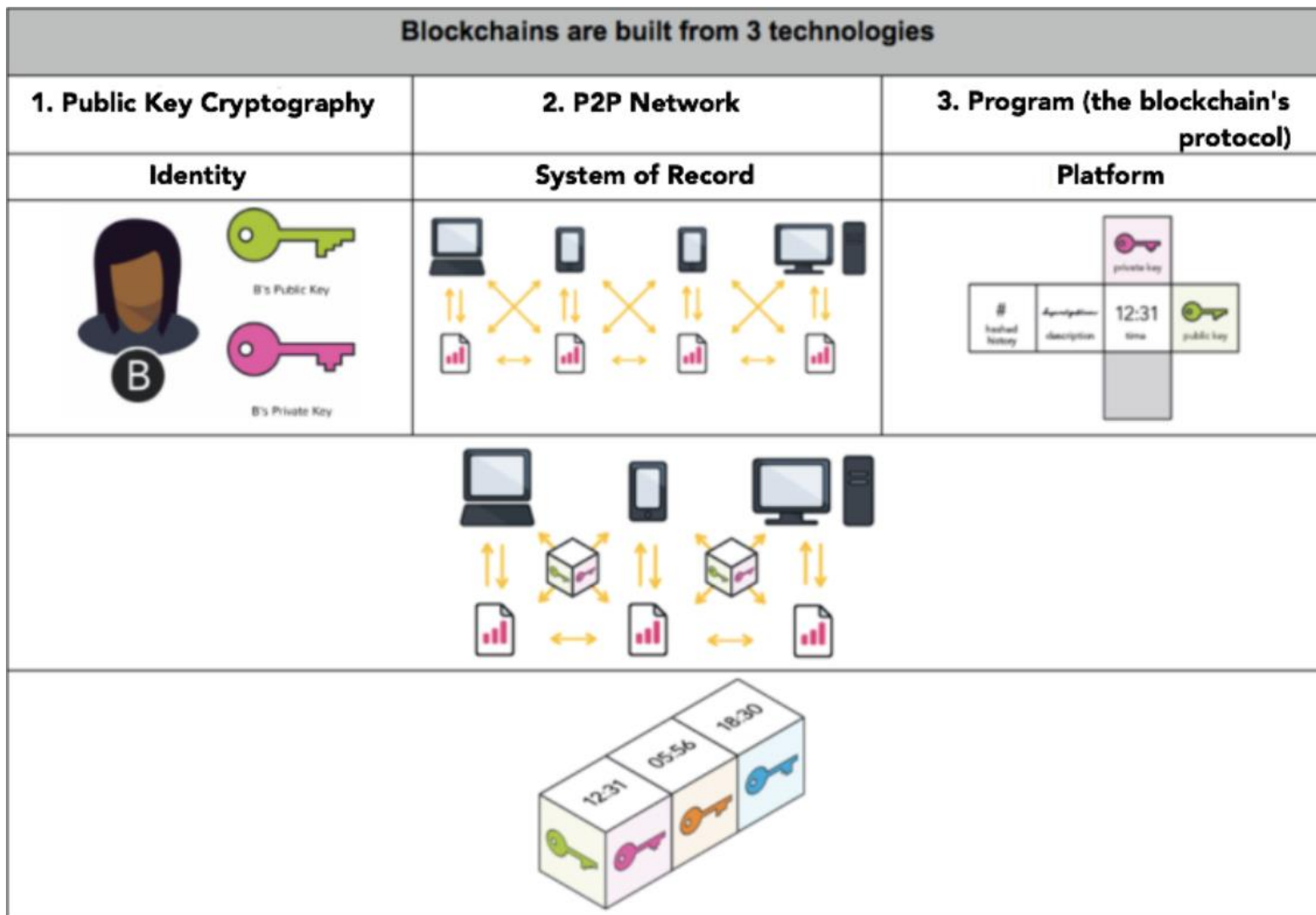


Users download a Bitcoin 'wallet' that works a little like an email address, providing a way to store and receive currency. Bitcoins can be transferred from one wallet to another using a web browser or

Businesses create a wallet in the same way as an individual user, typically using a website button to enable a Bitcoin payment. For in-the-flesh enterprises, QR codes can be used to let customers pay quickly



(Source: Coindesk.com)



(Source: Coindesk.com)

› Use Example – Cryptocurrency

Benefits?

- **Decentralized**: Universal, open source network which operates by consensus – not controlled by any one country or company
- **Limited Supply**: Differs from fiat currency in that supply can be limited by an underlying algorithm
- **Pseudonymity**: Users do not need to disclose identity, yet law enforcement has developed methods to track transactions and identify users
- **Immutability**: Transactions cannot be reversed, unlike electronic fiat transactions
- **Fungibility**: Individual units are essentially interchangeable facilitating use as a medium of exchange
- **Divisibility**: The numeric divisibility of cryptocurrency can enable micro-transactions

› Cryptocurrency vs. Token

More broadly, cryptoassets can be divided into 5 categories:

1. **Currency Tokens** – Cryptocurrencies which serve as money and store of value
2. **Security Tokens** – Represent claims on off-chain assets
3. **Utility Tokens** – Designed for specific uses on a variety of networks
4. **Brand Tokens** – Designed as tradeable digital assets on a single entity's network
5. **Platform Tokens** – Required for general purpose use on platforms (i.e. gas)

➤ Initial Coin Offering (ICO)

What?

- Refers to the creation and sale of digital tokens as a fundraising mechanism for businesses and individual projects

How?

- Digital tokens are created and sold to the public to raise capital
- Tokens provide buyers with access to a service or claim to assets/income
- Tokens provide issuers with a funding source and help build user base

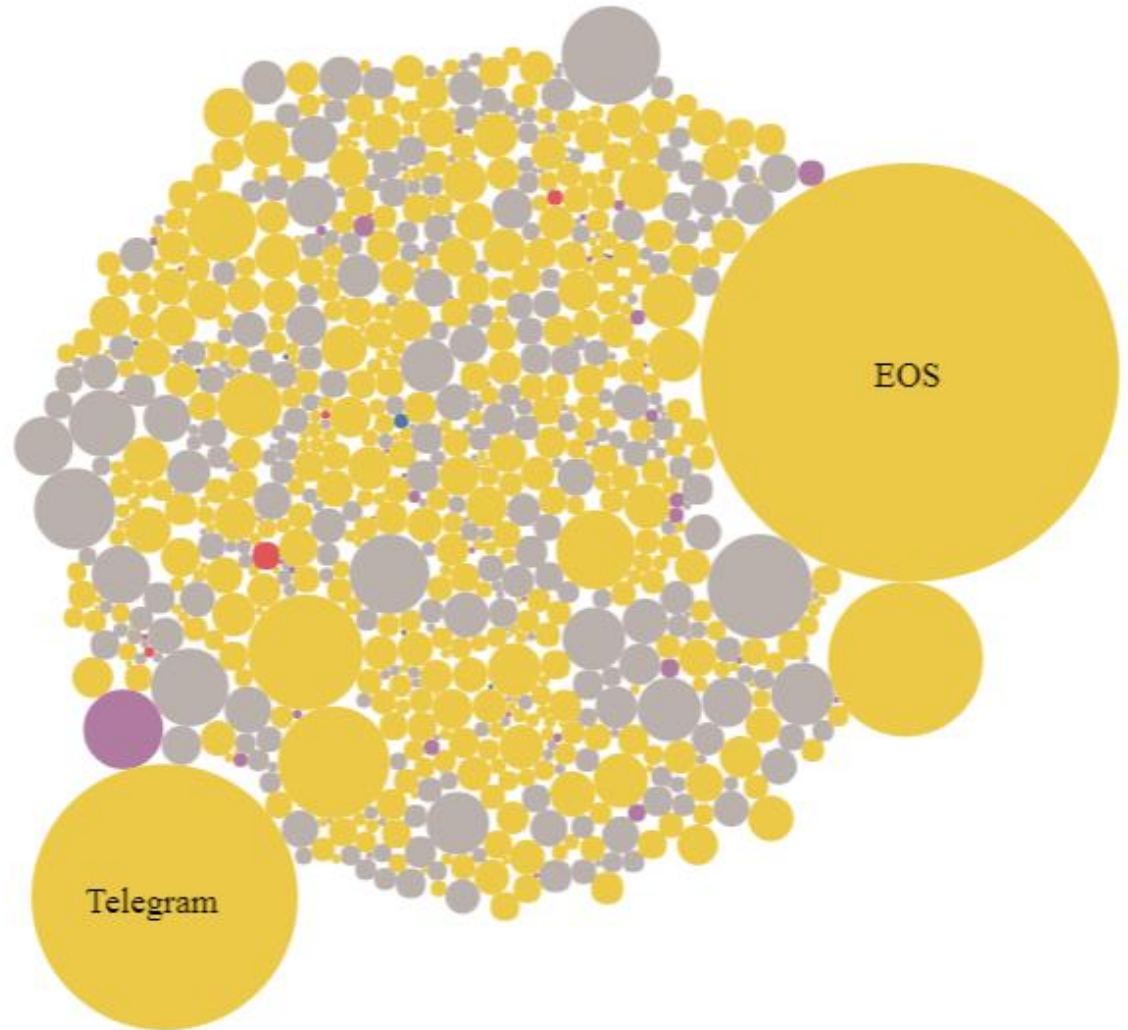
Benefits

- Provides a unique funding source for issuers
- Participants incentivized to use network
- Potentially more efficient than traditional financing methods

Year

- 2014
- 2015
- 2016
- 2017
- 2018

ICO Tracker



➤ Other Potential Blockchain Uses



- **Securities**
 - Post-trade settlement
 - Derivative contracts
 - Securities issuance
 - Collateral management
- **Trade Finance**
 - Bill of Lading
 - Cross-currency payment
- **Syndicated Loans**
- **Intra-bank Settlement**
- **Retail Banking**
 - Cross border remittances
 - Mortgage verification
 - Mortgage contracts (smart contract)
- **Public Records**
 - Real estate records
 - Vehicle registrations
 - Business license and ownership records

› When?...will it impact companies at large from supply chain side?

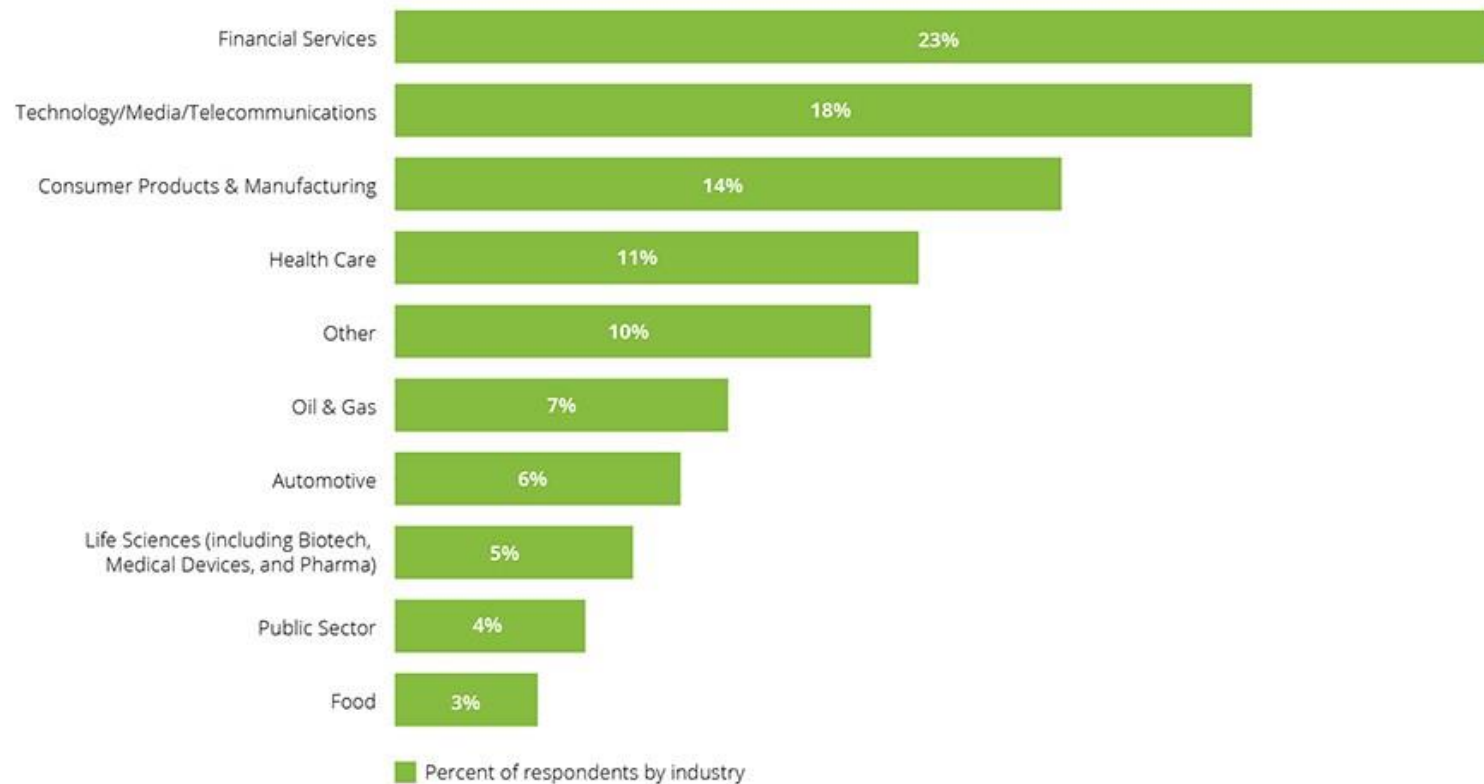
No longer accurate to call blockchain a key technology for the future — because it's already getting significant use today.

- More than three-fourths (77%) of 600 executives in 15 countries surveyed by a PwC study have active blockchain initiatives underway (reflects the fortune 1000 companies primarily):
 - 15% have a blockchain project fully live.
 - 10% have a blockchain implementation pilot in progress.
 - 32% have a blockchain project in development.
 - 20% are in research mode on a blockchain project.
- NOTE – remember products without a UPC code? Not many today are distributed without it – first code scanned in 1974 at retail checkout and mainstream variants in retail by late 80's – blockchain is predicted to grow faster than this due to increased pace of technology.

Primary operations of organizations by industry

Survey respondents hail from 10 different industries--the majority from financial services, technology/media/telecommunications, and consumer products and manufacturing.

Q: In which of the following industries does the organization you work for primarily operate?



N= 1,053 (global)

Per 2018 Deloitte Study and Survey

FOCUSED. ON YOU.

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