Blockchain overview and application

November 2015

Passion to Perform

Contents

Section 1

Blockchain overview

Blockchain introduction

Transaction process

1 A new block of transactions is received by network nodes (or "miners")

2 Each node validates (or "mines") the transactions via "proof-of-work", then broadcasts the block to all nodes for voting
– Nodes accept the block only if all transactions in it are valid and not spent

3 Once majority accepts the block of transactions:
– The block is appended to the longest chain
– The nodes are compensated by (a) new coin issuance, and/or (b) transaction fee from the buyer/seller

Blockchain – A trustless, decentralized, public database of growing records ("public ledger")

- Goal: to prove and transfer ownership without the need for a trusted third party
- Public and private cryptography:
  – Public key: account numbers that everyone can see in the public ledger but no real identity attached to them
  – Private key: let users transfer ownership (i.e. spend Bitcoins) on their corresponding public key
- "Proof-of-work" system: units of currency are mined by miners who use sophisticated systems to run computations required to secure and verify transactions and record them in the "blockchain"
  – New transactions are broadcasted to all nodes, each node collects transactions into a block and works on finding the proof-of-work for its block
  – When a node finds a proof-of-work, it broadcasts the block to all nodes and earns a pre-defined amount of the currency if the block is accepted

Illustrative blockchain

Crypto-currency network
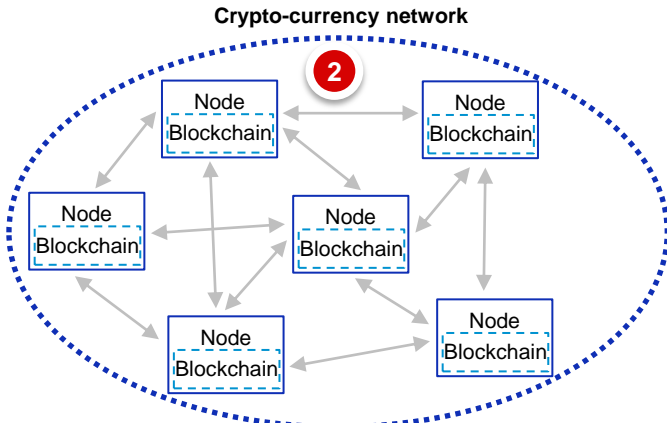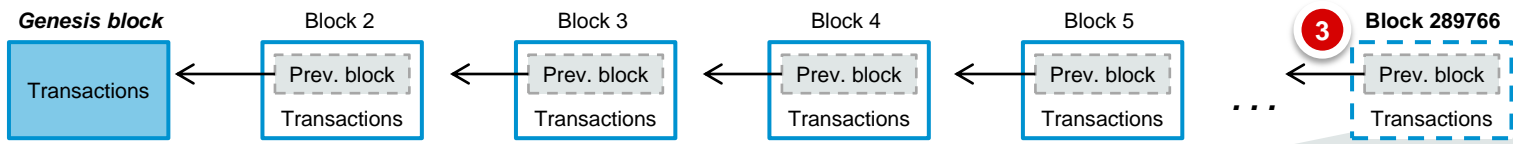
The network is made of interconnected "nodes" (end-user software and CPUs), that are in charge of validating any transactions received

Block 289766
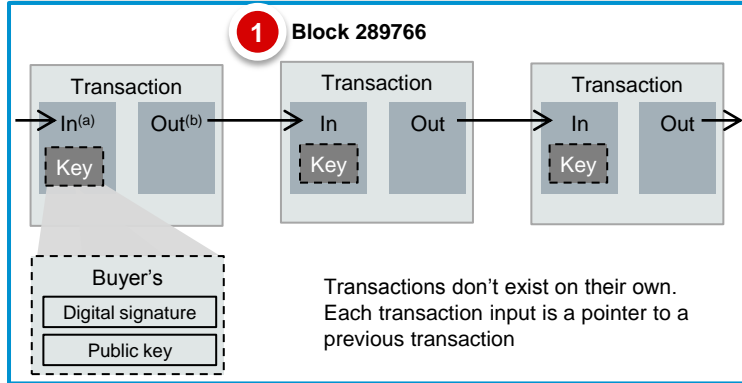
Transactions don't exist on their own. Each transaction input is a pointer to a previous transaction

(a) Input holds address of the buyer and contains the buyer's public key (i.e. account number) and private key (i.e. digital signature to execute transaction)
(b) Output holds address of seller

Crypto-currency market

- As of November 2015, 660 publicly traded crypto-currencies are equivalent to over $6.2bn USD market capitalization

- The top 15 most traded currencies account for 98.7% of total market cap

- There are 5.3m Bitcoin wallets

- 63,000 merchants accepted Bitcoin as a payment method including Overstock and Virgin Atlantic

		Name	Market Cap($m)	Price	Volume (24h, $m)	% Change (24h)
1		Bitcoin	$5,688.37	$383.86	$71.51	0.07%
2		Ripple	155.61	<$0.01	0.37	0.75%
3		Litecoin	147.53	$3.42	4.25	(3.34%)
4		Ethereum	76.79	$1.03	1.92	4.70%
5		Dash	15.53	$2.60	0.09	(0.94%)
6		Dogecoin	14.12	<$0.01	0.12	0.14%
7		Peercoin	10.05	$0.44	0.13	2.25%
8		Stellar	9.80	<$0.01	0.00	1.91%
9		BitShares	7.82	<$0.01	0.09	(11.86%)
10		TRMB	7.07	$0.16	0.36	(0.11%)
11		Nxt	6.51	$0.01	0.04	(8.17%)
12		MaidSafeCoin	6.13	$0.01	0.01	(0.02%)
13		Namecoin	5.60	$0.44	0.04	(4.45%)
14		Bytecoin	5.58	<$0.01	0.01	1.37%
15		Monero	4.75	$0.48	0.04	(5.15%)
		Total	**$6,161.27**		**$78.99**	

Comparison of different messaging and transaction settlement protocols

- Ripple was a payment protocol first, and a digital currency later

- Bitcoin was a digital currency first, and payment protocol later

- Ripple is striving to replace the current correspondent banking system

- Stellar has a similar network architecture but different go-to-market strategy. Ripple Labs, a for-profit organization, targets banks to use the protocol while Stellar, a non-profit organization, wants to distribute Stellar as fast as possible to end users

	Swift	Bitcoin	Ripple	Stellar
Architecture	Centralized	Decentralized	Decentralized	Decentralized
Settlement	Batch clearing, settlement through different ledgers at different banks	Proof-of-work, settlement on one public ledger (blockchains)	Consensus algorithm, settlement on one global ledger	Consensus algorithm, settlement on one global ledger
Speed	+ 2 business days	10 minutes	3-8 seconds	3-8 seconds
Peak volume	19m messages/day	7 transactions/second	Goal: 1,000 transactions/ second	Unproven
Currency supported	Fiat currencies	Bitcoin only	Universal	Universal
Transaction cost of the system	Operator fees	Free for users (miners accept new coins as fee)	Nominal security fees	Nominal security fees
Currency control	Governments	Bitcoin is capped at 21m; over 14m Bitcoins have been mined	No need for mining: 100bn was created in the beginning; no more XRP will ever by created	No need for mining: 100bn was created in the beginning; 1% annual inflation

Bitcoin basics
Uses legacy blockchain proof-of-work algorithm

- Bitcoin uses the <u>legacy blockchain protocol</u> and network

- The unit of the network is bitcoin (BTC). The currency is math-based and <u>capped at 21m units</u>

- Bitcoin believers seem to grab onto the ideology of bitcoin as an escape from centralized control. Many are still skeptical of Bitcoin as the alternative to fiat currency

- Most agree that the public ledger-based technology that underlies bitcoin could hold promise

Miners (how are bitcoins created?)

- Bitcoins are "mined" by "miners" – people or institutions that employ sophisticated systems to run math computations required to verify transactions and record them in the "blockchain"

- Miners are awarded bitcoins if they are the successful miner (and sometimes a transaction fee)
  - Current reward for completing a block is 25 BTC (~$7.6k)

- System designed to have an arbitrary max of 21m bitcoins to be mined at a predictable pace
  - All bitcoins are expected to be mined by 2140, after which transaction fees alone are expected to be sufficient compensation for miners to maintain the blockchain

Wallet (how do I store bitcoins?)

- Three main types of wallets:
  1. Software wallet stored on your computer's hard drive
  2. Mobile wallet that runs as an app on your smartphone
  3. Web/cloud-based wallet services

- A wallet contains public keys (equivalent to bank account numbers)
  - For every public key, there is a corresponding private key that allows you to spend funds of that address

- Wallets stored in places with an internet connection are referred to as "hot" wallets; offline storage locations are "cold" wallets

- Wallets are susceptible to theft (via hacking), hard drive crashes or corruption
  - Once lost, bitcoins are gone forever unless backups exist

Exchange (how do I obtain bitcoins?)

- Mining: requires very sophisticated computing power now; maybe out of reach for most people and institutions

- Exchanges: 100+ exchanges exist around the world
  - Typically requires proof of identity in order for exchanges to comply with "know your customer" or anti-money laundering requirements

- Individuals: various websites and apps allow direct one-on-one transactions

- ATMs: a handful of ATMs have sprung up that take cash in exchange for a paper receipt with codes necessary to load bitcoins onto your wallet

Transaction (how do I transact in bitcoins?)

- Each transaction contains three pieces of info:
  1. Input: record of where bitcoins you plan to send came from
  2. Amount of bitcoins you are sending
  3. Output: an address you are sending the bitcoins to
- There is no "balance" of bitcoins to spend, only a series of transactions – a past transaction in which you received bitcoins is forwarded on when you want to pay someone else
  - If amount of the new transaction does not precisely match the amount of the old transaction, another transaction will send you the difference
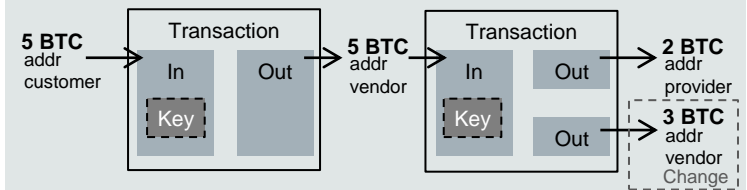
Ripple basics
Uses modified blockchain consensus algorithm

– As the first distributed currency exchange, Ripple can help lower cost of FX

– Regulator- and bank-friendly: banks can become gateways to earn transaction fees. They can still follow KYC/AML compliance

Technology and business model

– Primarily **used for interbank transfers**, Ripple borrows Bitcoin's decentralized concepts to build a payment protocol that enables faster, cheaper, and real-time payments
  – Banks can easily integrate into Ripple protocol
  – Regulators can still regulate banks to follow KYC/AML rules in the network

– Enables different currencies to enter its network via gateways to trade on a single ledger to reduce settlement risks

– Consensus algorithm:
  – Broadcast the same transaction to all Ripple servers within its network; ledger is updated once consensus is reached among the supermajority (80%) of validators
  – Does not rely on mining to reach consensus

Use cases

– Remittance service for retail customers
  – Real-time settlement and complete transaction traceability lowers the total cost of settlement
– International transaction banking service
  – Settle funds internationally in real-time, so banks can repackage and provide this service to other regional banks
– International corporate payments
  – Enhances corporate treasury solutions portfolio with real-time, on-demand international payment services
  – Help achieve greater working capital management
– Cross-border intra-bank currency transfers
  – Banks with branches in different countries can use Ripple to transfer funds at a fraction of the time and cost
  – Allocate capital more efficiently across international operations

Ripple's XRP functions as a bridge currency

– XRP is Ripple's native currency that does not have a counterparty; it's only used as an exchange tool

– XRP allows market makers to trade with each other without the need of connecting to both gateways or having USD or other currencies pre-funded in their accounts

– 100bln XRP units were created in the beginning. No more XRP will ever be mined

Independent account
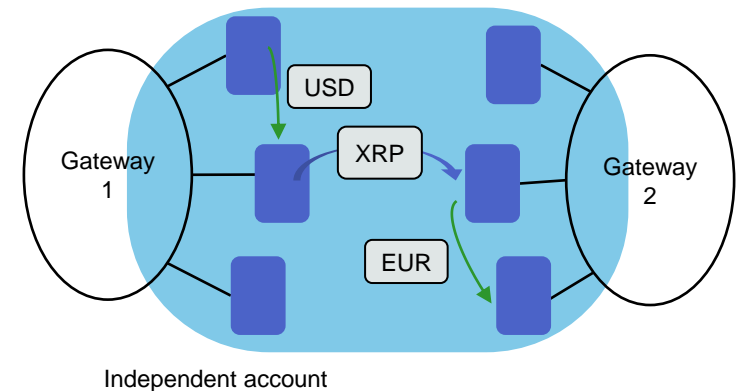
Ripple basics (continued)

Today	With Ripple

Cross-currency payments

Today, cross-currency payments sent via intermediaries take two to four days and are burdened with counterparty risk and lifting fees from each bank

With Ripple, financial institutions can send payments in three to six seconds without intermediaries via liquidity provided by market makers

FX cost: $$$

USD ▶ EUR

Central counterparty

Central counterparty

Sending bank

Sending correspondent/ liquidity provider
Lifting fees

Receiving correspondent
Lifting fees

Receiving bank

Liquidity provider A
FX cost: $

Sending bank

USD ▶ EUR

Receiving bank

Liquidity provider B
FX cost: $$$

Domestic payments

Today, banks clear transactions through ledgers controlled by a central counterparty (i.e. clearinghouse or central bank)

With Ripple, financial institutions can clear transactions bilaterally in real-time and settle net positions via traditional RTGS system, lowering costs and risks of real-payments

Payment instructions

Time + 1

Bank A

Bank B

Settlement

Central Bank

Time + 2

Payment instructions

Real time

Bank A

Bank B

Central Bank

Settlement

EOB
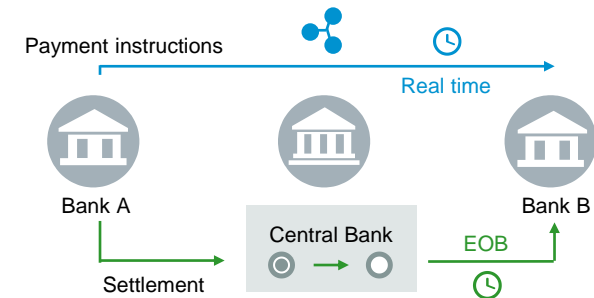
Bitcoin industry commentary

Takeaways

- The biggest divide in opinions seems to be between the strength of Bitcoin as a centralized peer-to-peer platform and the weakness of bitcoin as a viable currency

- Some view bitcoin as a commodity rather than a currency with early investor interest signaling nothing more than a speculative bubble

- While Bitcoin has enabled greater interoperability, it remains more suited for consumer and merchants than financial institutions

Enthusiastic

"The core technological problem that [Bitcoin] has solved has never been solved before…the ability to prove and transfer ownership without the need for a trusted third party…payments is the first application of [this]…but there are more."

"[With existing networks,] you are putting all of the vulnerable information out there. The same thing does not happen in Bitcoin. When you send somebody money, it is publicly verifiable…but, you need not give over your payment credentials."

"From a merchant perspective, there is also the benefit that there are no charge-backs. Once a payment is made, it is not reversible. Merchants today pay about 30 basis points of their total flow away due to fraud, which would be avoided."

- Fred Ehrsam, Co-Founder of Coinbase

"In my view there is a voracious demand for new bitcoin and, similar to silver, prices will have to rise dramatically to meet it. Specifically, I think the call on bitcoin could very reasonably be $150 billion, which places it, ironically, in the same ballpark as the valuation of Amazon and of Greece's M1 money supply."

- Daniel Masters, Founding Co-Principal and Portfolio Manager of Global Advisors

"We have a very strong belief in the form that the ledger that nobody owns will be the thing that draws all of the developers and the best payment functionality, wire transfer, foreign currency exchange, and all kinds of functionality that you can't even imagine now."

- Ben Horowitz, Co-Founder and General Partner of Andreessen Horowitz

Skeptical

"[Bitcoin] would not be a good substitute [for fiat currency] because we actually do want the government to control the money supply"

"The internet empowered the government rather than citizens…I am therefore skeptical about the idea that bitcoin is liberating and allows people to evade government control. "

- Eric Posner, Professor of Law at the University of Chicago

"On net, we find that bitcoin is easier to store and transport and is potentially more difficult to counterfeit, but it is not nearly as 'stable' as gold, and competitors still pose a greater risk."

- Jeff Currie, Head of Goldman Sachs commodities research

"Banks are being cautious and banking relationships for bitcoin-related businesses are hard to come by. This is a key concern because the difficulty in getting banking relationships is a gating issue for the development of a robust Bitcoin ecosystem here in the US."

- Dax Hansen, Partner at Perkins Coie, LLP

"I think this is about the methodology: the distributed confirmation and security of the blockchain and its applicability in the settlement of transactions within capital markets. And that can be done without bitcoin."

- Nasir Zubairi, Venture Partner at FinLeap

"Bitcoin has two key limitations as a new financial system: it either requires the whole world to adopt bitcoin as a global currency, or it requires users to trade in and out of fiat currencies—resulting in the same currency risk that exists today.

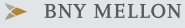*- Chris Larsen, Ripple Labs CEO and Co-Founder*

Deutsche Bank
Corporate Banking & Securities

Section 2

Banks using blockchain technology

Financial institutions have begun exploring blockchain technology to improve money transfer and payment processes

Name	Description	Blockchain platform used	Use case	Sign-on date	Indicative size ($bn)	
					EV	Revenue (2014)
CBW Bank	– State chartered commercial bank, which provides online banking services to individuals, corporations, and small businesses as well as internet banking features – Founded in 1892, Kansas	– Ripple	– Real-time payments between U.S. and other countries globally; augment its platform for payments with Ripple to enable secure, instant, cross-border funds transfers in any currency for consumers, credit unions, and other banks	Sep 2014	n/a	n/a
Cross River Bank	– Operates as an independent community bank – Founded in 2009, New Jersey	– Ripple	– Offer its business and personal banking customers real-time international payments between U.S. and Western Europe – Integrated Ripple's settlement infrastructure for instant, secure, compliant, and more affordable cross-border money transfer services	Sep 2014	n/a	n/a
Fidor Bank	– Provides banking and financial services. Offers cash management tools, savings and credit products, as well as investment transactions in foreign currencies. – Founded in 2003, Munich, Germany	– Ripple	– Integrated Ripple protocol into its transaction infrastructure to power inter-bank payments with other institutions and its own branches	May 2014	n/a	$.02
Commonwealth Bank of Australia	– Provides banking and financial services. The company operates through the following segments: Retail Banking Services, Business and Private Banking, Institutional Banking and Markets, Wealth Management, New Zealand, Bankwest and IFS & Other. – Founded in 1911, Sydney, Australia	– Ripple	– Use Ripple to facilitate payments between its subsidiaries; test in a controlled environment what a bank-to-bank internal transfer might look like using crypto rather than existing payment providers	May 2014	$213.09	$45.31
Western Union	– Provides global money movement and payment services; operates through three segments: Consumer-to-Consumer, Consumer-to-Business and Business Solutions – Founded in 1851, Englewood, CO.	– Ripple	– Running a pilot with Ripple, details not disclosed	Apr 2015	$10.83	$5.61
BNY Mellon	– It provides financial services for institutions, corporations and high-net-worth individuals; operates through three segments: Investment Management, Investment Services and Other. – Founded on July 1, 2007, New York, NY.	– Bitcoin open source	– Modified Bitcoin's open source code to run internal network and created BK coins	Jan 2015	$73.32	$15.12

Note: EV based on share price as of 10/28/2015
Sources: Company data, FactSet, Coinbase

Financial institutions have begun exploring blockchain technology to improve money transfer and payment processes

Name	Description	Blockchain platform used	Use case	Sign-on date	Indicative size ($bn)	
					EV	Revenue (2014)
BNP Paribas	– Operates through retail banking, investment solutions, and corp and investment banking – Founded in 1966, Paris, France	– Not disclosed	– Adding bitcoin to one of its currency funds	n/a	$626.77	$122.21
Citi	– Operates through global consumer banking businesses, institutional clients group, and corporate activities – Founded in1998, New York, NY	– Built three blockchains in-house; created own crypto-currency, Citicoin	– Not disclosed	n/a	$563.67	$89.34
UBS	– Operates through wealth management, retail & corporate, global asset management, and investment bank – Founded in1998, Zurich, Switzerland	– Opened a blockchain technology research lab at Level 39	– Not disclosed	Apr 2015	$246.03	$39.78
Barclays	– Operates in 9 segments: UK retail & business banking, EU retail & business banking, Africa Retail & Business Banking, Barclaycard, Investment Bank, Corporate Banking, Wealth & Investment Management and Head Office Functions & Other Operations – Founded in 1896, London, UK	– Safello / bitcoin	– Not disclosed	Jun 2015	$400.92	$53.42
Banco Santander	– Operates 5 segments: retail banking, corporate banking, specialized business, global banking and markets – Founded in 1987	– Not disclosed	– Cross-border payments – Adoption of underlying technology, not the digital currency	Apr 2015	$447.32	$100.89

Note: EV based on share price as of 10/28/2015
Sources: Company data, FactSet, Coinbase

Section 3

Blockchain technology start-ups

Comparisons of start-ups that enable application of blockchain technology

According to a CB Insights report, Bitcoin is among the fastest-growing areas of startup investment, with $375.4m committed in the first half of 2015, compared to $339.4m in all of 2014

	Use case	Select players
Wallet	A secure, digital crypto-currency storage that enables making and receiving payments with merchants and users	– Blockchain Ltd. – Coinbase – Trezor – Xapo
Exchange	An online platform that facilitates the movement of cryptocurrencies and fiat currencies between users and across borders at faster speeds and reduced interference from third parties	– BitShares – Digital Asset Holdings – ShapeShift (crypto- to crypto- exchange) – Symbiont.io – Trustatom
Infrastructure / API	A suite of blockchain-related functionalities that is developed with the added capability to be integrated into other operating systems and products	– Blockstream – BitPay – Chain Inc. – Colu – Elliptic (security) – Stripe
Product	Physical hardware that enables consumers and developers to gain greater access to mining, transferring, and storing cryptocurrencies	– 21 Inc. – Case – CCEDK (NanoCard) – Robocoin – Trezor – Xapo

Coinbase has raised more than $106m including seed funding from investors:

– Andreessen Horowitz
– Blockchain Capital
– NYSE / ICE
– Union Square Ventures

Security

– Up to 97% of customer funds in cold storage offline
– Ensures the storage of bitcoins in the cloud
– Insurance policy against theft or hacking that covers max value held online

Business description

– Coinbase Inc. is a provider of bitcoin payment and wallet services that enables merchants and consumers to transact with bitcoin

– Currently the largest bitcoin wallet and merchant platform in the world

– The Company caters to 2.6m users and 41,000 merchants across 32 countries worldwide

– Coinbase has 4m bitcoin wallets and traded over $2.5bn worth of bitcoins

– The Company is headquartered in San Francisco, CA

– Coinbase was founded in 2012 by Brian Armstrong and Fred Ehrsam

Key features

Exchange	– Enables the buying and selling of bitcoin online – Offers transactions across four currency trading pairs: BTC-USD, -EUR, -GBP, -CAD – Operates on a maker-taker model under which orders that provide liquidity are charged different fees from orders taking liquidity
Merchants	– Offers a suite of merchant tools to enable businesses to accept bitcoins – No fees for first $1m bitcoin payments then 1% fee each conversion – Eliminate charge backs and reduce online fraud, while still allowing issuance of refunds
Developers	– Provides resources and API platform to build blockchain functionality in applications – Over 7,000 developer applications created

Recent developments

– October 1, 2015: Announced 26 European countries can now "instantly" purchase bitcoins with a 3D secured credit and debit card
– September 22, 2015: Filed 9 patents for products including a hot bitcoin wallet, instant exchange, tipping button, and two blockchain systems
– September 2, 2015: Expanded to Asia with Singapore market launch
– June 17, 2015: Launched Instant Exchange which allows users to send or receive bitcoin payments without exposure to bitcoin exchange rate risk
– June 15, 2015: Launched Coinbase Exchange Gem, an application programming interface for algorithmic trading
– November 20, 2014: Partnered with RewardsPay to integrate rewards redemption with bitcoin transactions

41,000 merchants accept bitcoins though Coinbase

Instant exchange: Converts immediately to fiat currency without exposure to exchange rate risk

Source: Company data, press

Blockchain wallets
Company overviews

Blockchain Ltd has raised more than $30m funding from investors including:

– Future Perfect Ventures
– Lightspeed Venture Partners
– Mosaic Ventures
– Prudence Holdings
– Wicklow Capital

BLOCKCHAIN

Business description

– Blockchain Ltd operates as a provider of Bitcoin wallet, Bitcoin APIs and block explorer & search engine

– The Company functions as a provider of services, a platform for other developers and a fully incentivized system for correction & fraud detection

– Blockchain also offers payment processing options, wallet application program interface tools for developers to get data, data on transactions per blocks and market data

– The Company caters to over 3.7m users and manages around 50,000 transactions daily

– Blockchain is headquartered in London, UK

– The Company was founded in 2011 by Peter Smith, Ben Reeves and Nicolas Cary

Product & services overview

Bitcoin wallet	– Enables users to make payments through smartphones and desktops – Available on android, iOS and Web platform
Blockchain explorer	Provides data on recent transactions; mined blocks in the blockchain; charts on the Bitcoin economy; and statistics & resources for developers
Blockchain merchant	Provides point-of-sale solution for restaurants, bars, cafes and other retail merchants accepting Bitcoin payments via the Blockchain API
Zeroblock	A mobile and Web application that combine live Bitcoin exchange data with up to the minute breaking news & charts

TREZOR

Business description

– Trezor offers the world's first hardware wallet to create an isolated environment to sign transactions offline (serving as "cold" storage)

– Ultimate security: Cryptocurrencies are kept safe through the product as it never exposes private keys and is backed by a unique PIN code that prevents misuse even if the TREZOR is stolen or computer hacked

– Transparent: Trezor code is open-source and technical decisions involve the entire community

– Accessibility: presented as a portable "bank" that allows for usage in international locations and does not charge fees

– Compatible with most operating systems, 8 independent wallet services (as well as its own, myTrezor), and top traded cryptocurrencies

– Trezor is the creation of SatoshiLabs, founded in fall 2013

How to use TREZOR: Ease of use
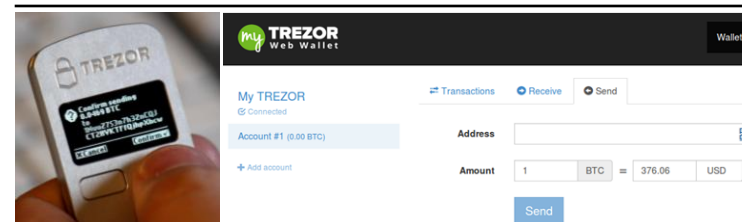
– TREZOR only has two buttons, one to confirm and one to deny the transaction

– To receive payments, TREZOR provides unique QR addresses that are specific to who's paying (employer vs. customer) and can only be matched with what's displayed on the TREZOR screen (prevents hackers from providing a fake receiving address)

– To make payments, the user must enter the PIN into TREZOR, see that the amount and address match on screen, and manually push the "confirm" button

Smart Contracts

Blockchain feature that can automatically execute the terms of a contract when pre-set conditions are met

Use cases:

- Eliminates middleman operational inefficiency by facilitating recurring payments

- Withdraw from neutral account for trading platform when asset prices reach certain preset level

- Immediately pay merchant / vendors upon notification of product or service delivered / received

- Provide customers / clients a proof of performance

Business description

- BitShares Inc. engages in developing a blockchain based on an industrial-grade financial services Smart Contract platform

- With BitShares 2.0 launch, will provide a network that is scalable to process over 100,000 transactions/second (nearly NASDAQ speed)

- BitShares are mined at a gradual rate, reaching zero in twelve years, encouraging early adoption (currently #4-5 traded crypto-currency)

- The Company is headquartered in the US

- Founded in 2013 by Daniel Larimer, Charles Hoskinson and Stan Larimer

Key features

Price-stable cryptocurrencies	Provides SmartCoins that offers the freedom of crypto-currency with the stability of the dollar
Decentralized asset exchange	A fast and fluid trading platform; now with OpenLedger utilizing its platform, also the world's first decentralized, multi-lingual exchange
Collateralized bond market	An investment marketplace accessible to anyone with an internet connection that integrates peer-to-peer lending
Stakeholder accessibility	- *Delegated Proof-of-Stake (DPOS)*: a consensus model that leverages the power of stakeholder approval voting to resolve consensus issues in a fair and democratic way - *Stakeholder-approved project funding*: A self-sustaining funding model that provides stakeholders the power to direct where blockchain reserves (1.2bn BTS, ~$8m) are spent

SmartCoins: trading platform that eliminates price volatility

Pay out dividends
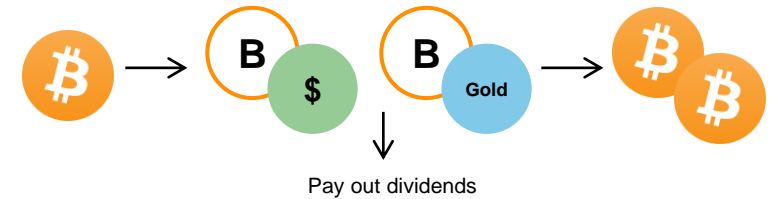
The trading system is comprised of two components:

1. BitShares – crypto-currency, serves as collateral to back BitAssets

2. BitAssets – new type of financial derivative, a pairing of BitShares with a "real-world" asset (USD, gold), used to hedge the value of BitShares against that asset, pegged to market prices

Fee and structural comparisons

WESTERN UNION Money transfer services	Average bank wire fee (US)	bitshares Transaction on BitUSD
$12 fee	$45.50 fee	< $0.05 fee
Up to 3 days	2-3 business days	Instant

Consensus method	Validators	Rewards	Validation process
bitshares (Delegated Proof-of-Stake)	Voted in by BitShares community, 101 delegates	Shared by delegates	Delegates verify each other; relies on trust
bitcoin (Proof-of-Work)	<10 mining pools	Only pools with significant hash (mining) power	Solve cryptographic algorithms

Blockchain exchanges - financial services-focused
Company overviews

symbiont

Digital Asset Holdings

Symbiont.io

> "[Smart Securities] encodes execution data and publication data in transactions, publishing to the blockchain, so all the data is on the bitcoin blockchain…[Other companies] are using colored coins on top of bitcoin to represent assets that are stored and issued and traded offchain. Symbiont's system is smart securities, so you're issuing and managing the securities all on the chain itself."
>
> *Adam Krellenstein,*
> *CTO, Symbiont.io*

Business description

– Symbiont.io Inc., a FinTech company that operates an online trading platform

– The Company provides a platform for issuing and trading Smart Securities or self-executing digital contracts using blockchain technology

– Symbiont supplies solutions to regulated institutions such as banks and broker-dealers

– Symbiont has raised $1.25m in funding from several angel investors and Celeridem FinTech Fund

– The Company is headquartered in New York, NY

– Symbiont was founded in 2015 by Mark Smith as a merger between 2013 start-ups MathMoney, a specialist in cryptographic currencies, and Counterparty, the creator of the wallet, Counterwallet

Smart Securities

– Smart Securities: programmable versions of traditional securities that take the form of self-executing digital contracts that are stored in a distributed ledger / blockchain

 – Allows institutions and investors to issue, manage, trade, clear, settle and transfer a range of financial instruments more efficiently on decentralized and distributed peer-to-peer financial networks that are cryptographically secured

 – Symbiont has converted its founders' stakes, shares, and employee options to encrypted code that lives in the bitcoin blockchain

 – Initial use cases for Smart Securities include corporate debt, syndicated loans, securitized instruments and private equity

 – Example: A corporate bond can be issued as a Smart Security with elements including coupon amount and date so that payments are made immediately to owners across the blockchain with minimal interference with clearing and settlement

Business description

– Digital Asset Holdings (DAH) plans to utilize its software platform specifically for sophisticated financial institutions

– DAH provides settlement of conventional and digital assets and blockchain-type ledger to create, issue, track and transfer mainstream financial assets

– On June 25, 2015, acquired Hyperledger and Bits of Proof

 – Hyperledger operates as a technology firm that developed a distributed ledger to enable banks and other financial institutions to clear and settle transactions in real-time

 – Bits of Proof operates as a software company that has built and deployed an enterprise level server to integrate blockchain technology into financial applications

– The Company is headquartered in in New York, NY with additional offices in Budapest and Tel Aviv

– DAH was founded in 2014 by Donald Wilson and Sunil Hirani

Product solutions overview

Syndicated loans	– Offers tokenization of title to complex loan agreements and subsequent secondary provisions managed on a shared ledger
US Treasury Repo	– Digitize, authorize, record, net and settle transactions in bilateral, tri-party & cleared repo
Securities Settlement	– Facilitate cryptographic cap tables of all accounts for participants in the intermediary chain so regulators can have full visibility into the system
Others	– Exploring the potential of distributed ledger technology for different use cases including forex, payments, public stock, derivatives, transaction reporting, factoring, bonds and digital currencies

Source: Company data, press

Business description

– Blockstream extends the basic Bitcoin protocol to integrate crytpocurrencies, open assets and smart contracts in a developer-stage platform (primarily API)

– "Economic singularity" mission: an internetwork of chains, building on the existing Bitcoin network effect with smart contracts and enabling more streamlined financial transactions

– November 2014: Blockstream announced closing a $21m seed round with investors including Reid Hoffman, Khosla Ventures and former executives at Google and Yahoo

– Financial use case: vesting stock or other time-triggering transfer of assets without relying on a custodian or escrow agent

– Founded by Austin Hill, Adam Back, Greg Maxwell and Alex Fowler and is headquartered in Montreal, Canada

Sidechain Elements

– June 8, 2015: Blockstream announces the launch of the first Sidechain prototype

– Sidechain: functions as a separately managed ledger, with its own software code and transactions, that is "pegged" to the main Bitcoin chain
  – Pegged: assets and data are validated and transferred between blockchains
  – The Sidechain method reduces the likelihood of liquidity shortages, market fluctuations, fragmentation, security breaches and fraud

– Two-way peg: Enables transfers between chains at a fixed exchange rate

– Asset types: stocks, bonds, derivatives, real / virtual currencies
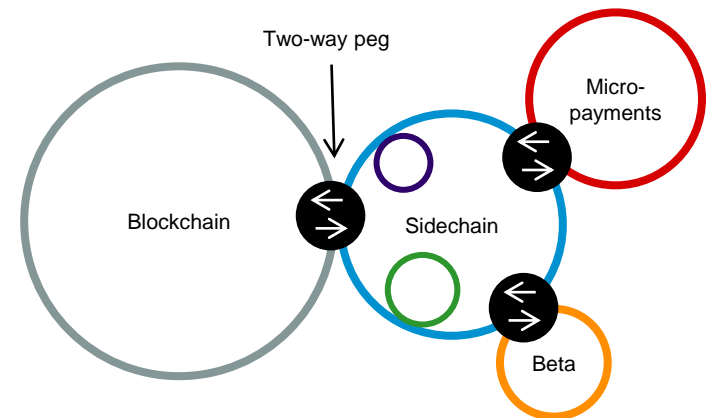
Micropayments (Lightning Network)

– Micropayments (Lightning Network): off-chain Bitcoin transactions, that can be securely performed without interacting with the main blockchain

  – No counterparty risk: if there is any disagreement in validity, the chain is closed and settlement brought up to the main chain

  – Instant payments

  – Potential to significantly scale up Bitcoin to "billions of transactions per day" with minimal use of the main blockchain and minimal fees

Sidechain model

Source: Company data, press

Blockchain infrastructure
Company overviews

Chain

bitpay

Chain Inc.

"Chain provides a developer-centric technology platform that is as intuitive as it is powerful. As we have begun exploring the tremendous potential of blockchain technology, the Chain team has served as a great strategic thought partner, including co-hosting an internal hack-a-thon that produced 12 different solutions in 48 hours."
Adam Boutin, Principal, Capital One Ventures

Business description

– Chain Inc. provides solutions primarily with financial institutions to design, deploy, and operate blockchain networks that enable seamless, programmatic and peer-to-peer transfer of digital assets
  – Asset types: financial securities, currencies, gift cards, mobile minutes, loyalty points, and energy credits
– Chain has raised $43.7m in funding to date
– After the recent Series B round, Forbes unofficially values Chain at $150m
– Chain has partnered with several large corporations such as First Data, Nasdaq, Salesforce.com, and Microsoft to host "sandbox" experiments (rapid prototyping)
– Chain Inc. was founded in 2014, and is headquartered in San Francisco, CA

Recent developments

– September 9, 2015: Chain Inc. raises $30m from Visa, Nasdaq, Citi Ventures, Capital One, and Fiserv

– June 17, 2015: Chain partners with Gyft, a First Data subsidiary, to power digital gift card issuance, transfer and redemption for small and medium businesses

– May 2015: Nasdaq selects Chain as its partner for a pilot project to test Bitcoin technology for the trading of shares in the Nasdaq Private Market, which includes 75 pre-IPO private companies

Business description

– BitPay is currently the world's largest bitcoin payment processor

– BitPay serves more than 60,000 merchants on six continents

– The Company has enabled over 40 integrations with companies including PayPal, Intuit, Shopify, WordPress, and Virgin Galactic

– October 6, 2015: BitPay partners with Ingenico to introduce bitcoin payments into traditional POS devices

– June 2015: BitPay released its first version of Copay, which allows users to hold bitcoins across multiple wallets and create joint accounts (multi-signature feature)

– BitPay was founded in 2011 by Stephen Pair and Tony Gallippi; headquartered in Atlanta, GA

BitPay key features

Platform	– Direct bank deposit: receive settlement directly in a bank account in 38 countries, 9 currencies – BitPay API that is publicly auditable and versatile for custom integration – Manage under and overpaid invoices and issue bitcoin refunds
E-commerce	Allow merchants to install plug-ins to enable bitcoin payments on any e-commerce website
Billing	Add a bitcoin payment option to bills sent to customers and clients
Retail	– Bitcoin Checkout: Accept bitcoin on any phone or tablet through a mobile POS application – Direct POS integration allows merchants to accept bitcoins natively on their current softwares

Source: Company data, press

Blockchain products
Company overviews

21 Inc.

– 21 Inc. encompasses a suite of Bitcoin infrastructure hardware

– As of September 2015, 21 Inc. is the first developer of a computer with native hardware and software support for the Bitcoin protocol

– Each computer contains a micropayments server that allows users to buy and sell digital goods over the Internet for bitcoins

– Machine-to-machine payments: 21 Bitcoin computer is primarily for developers rather than consumers, who can integrate the Bitcoin code into any operating system / product they build (game, music, online content) and stream profits

– In March 2015, 21 Inc. revealed plans to market smartphone chips to enable mobile gadgets to continuously earn digital currency through mining

– Financially backed by Qualcomm, Cisco, Andreessen Horowitz, and Peter Thiel to amass more than $116m funding, as of March 2015

– 21 Inc. was founded in 2013 by Balaji Srinivasan and Matthew Pauker; headquartered in San Francisco, CA

Robocoin

– Robocoin develops and operates the world's first bitcoin ATMs as well as a bitcoin wallet and API that allows any kiosk to accept bitcoins

– April 21, 2015: Robocoin introduces Romit, which allows users to send cash through their ATM to another Robocoin ATM at much lower, global remittance fees

– October 28, 2013: Robocoin's first Bitcoin ATM launched in Vancouver, and in three months, transactions totaled ~$1m

– 20 ATMs have been installed around the world, including the US, Canada, Hong Kong, and Italy, resulting in over 35,000 transactions

– Withdrawal process:
  – The ATM generates a code to be scanned with a mobile phone
  – After confirmation from the Bitcoin network to the phone, the ATM will release cash
  – The ATM is equipped with a hand scanner as an AML measure and a camera which matches the identity of the user with a government-issued ID

– Robocoin is a Las Vegas-based startup, founded by John Russell and Jordan Kelley

NanoCard Mastercard / Xapo Visa

– Originally, debit cards required users to first top-up the balance by manually converting bitcoins to fiat currencies, like a prepaid card

– Now, new debit cards unveiled by CCEDK and Xapo include a service that links the card directly with the users' online bitcoin wallet

– Xapo, a bitcoin wallet, announced its Xapo Debit Card release in April 2014 to be compatible with EUR, USD, and GBP

– Xapo partnered with Visa to allow purchases in stores and withdrawals from ATMS around the world

– NanoCard , released in July 2015, is a collaboration between Danish bitcoin exchange CCEDK and forex platform Bit-x

– NanoCard key features: instant funding, low commission / service fees, no verification necessary, and BTC, LTC, USD, EUR, and GBP accepted

Blockchain debit card process

Source: Company data, press