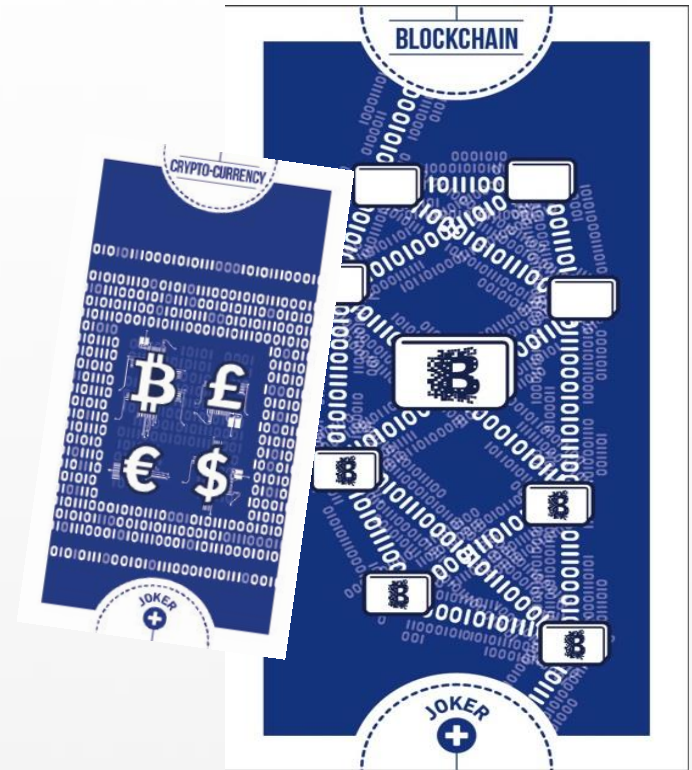# BLOCKCHAIN OVERVIEW

- HISTORY
- PROOF OF CONCEPT
- FEED BACK
- GO LIVE
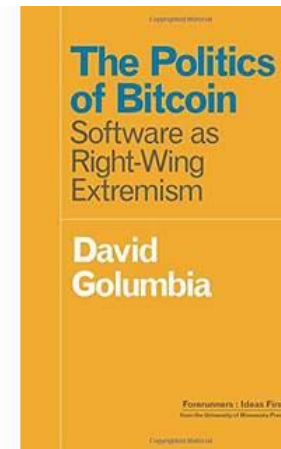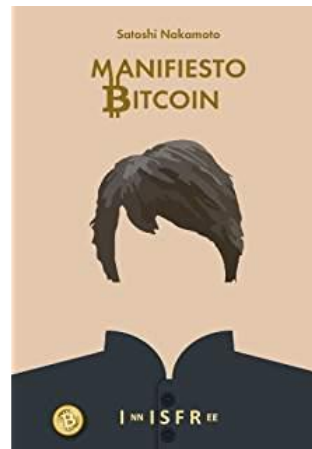
PHILIPPE DENIS

HEAD OF CIB BLOCKCHAIN LAB
CDO BNP PARIBAS SECURITIES SERVICES

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Bitcoin on Amazon
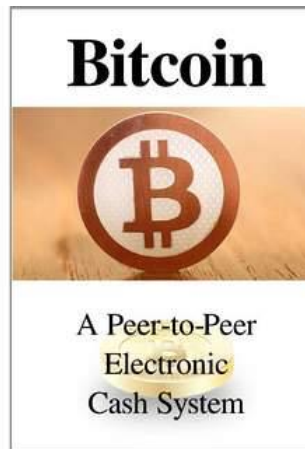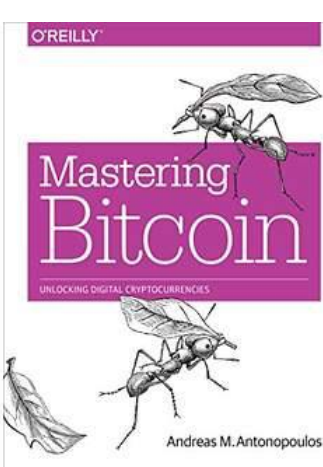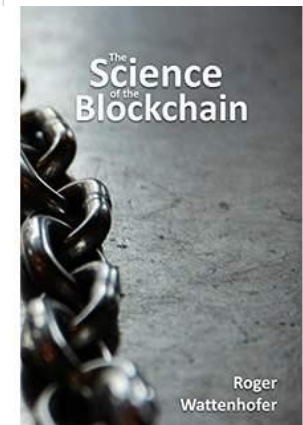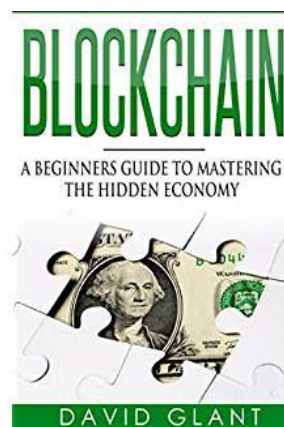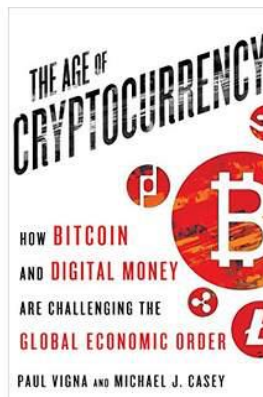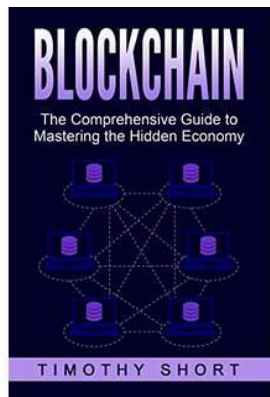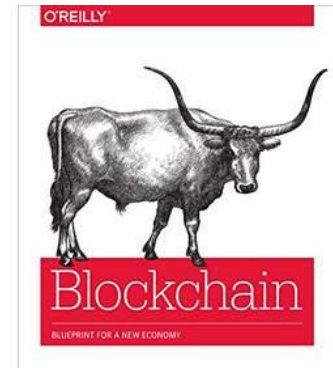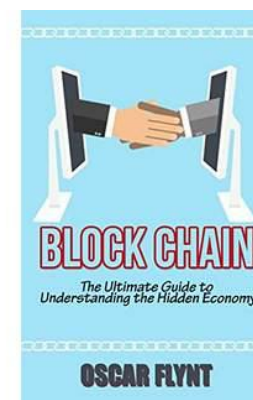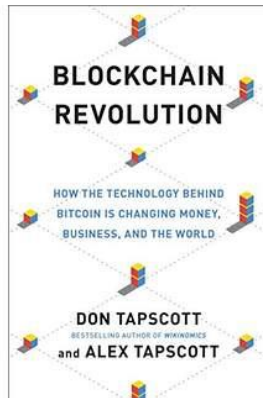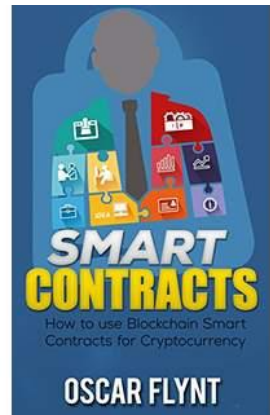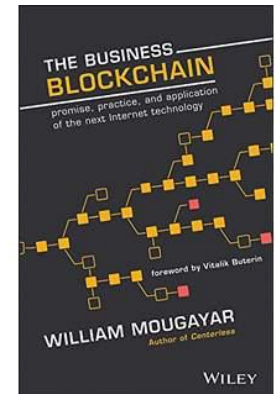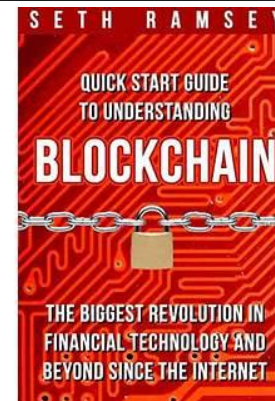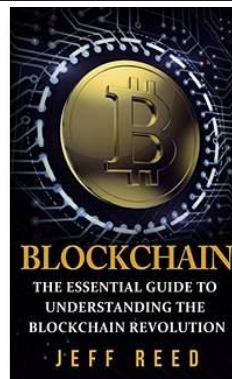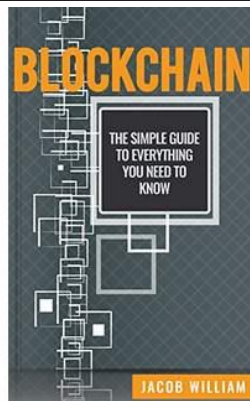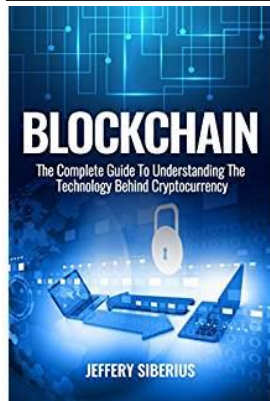
What is it ?

Ledger visible from all parties

Transactions since the beginning

Irrevocable and indelible transactions

Cryptography Private / Public Key

Distributed model on a network of computers

Consensus
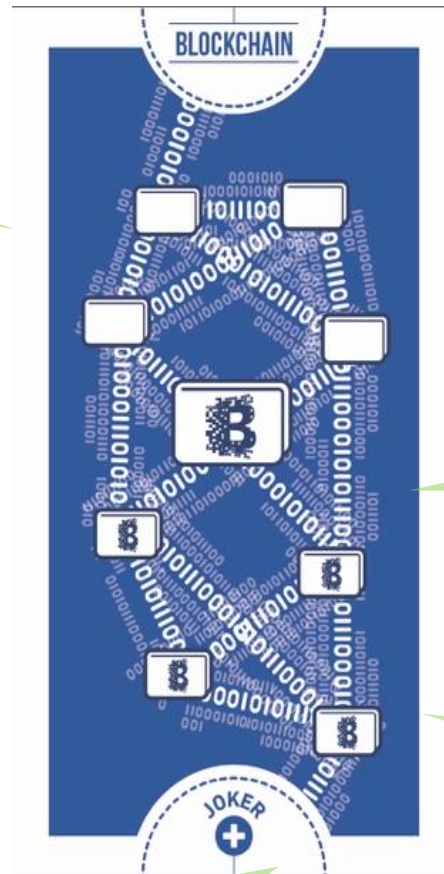
2011
Satoshi Nakamoto

How does it work? A dive in crypto currency mechanics

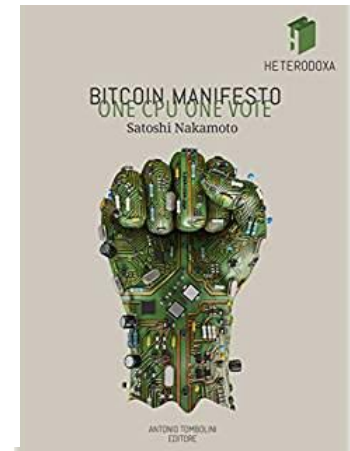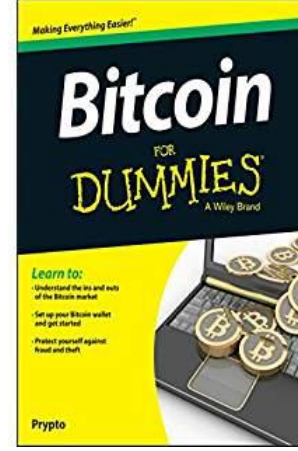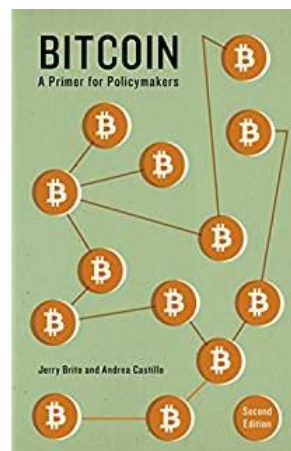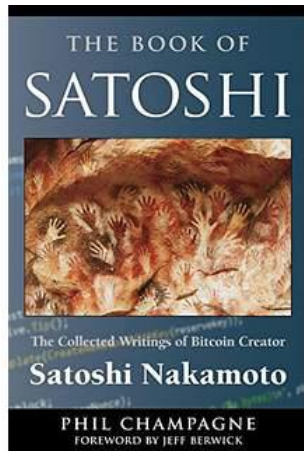| Decentralised depositary | A worldwide messaging and payment system | A settlement platform |

Send 1 BTC to

"Settlement" batches approx. every 10 min

Address acts as an "account number"

Private key to prove ownership of funds

Peer to peer network
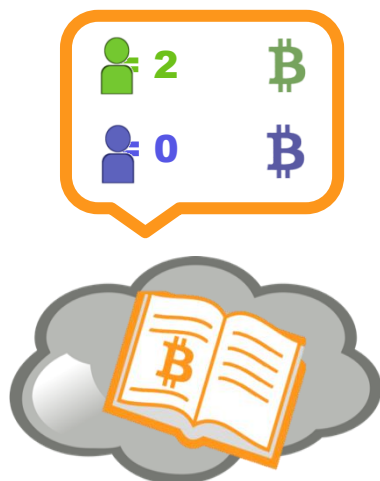
No central authority however nobody can corrupt or manipulate the registry (the blockchain)
Cryptographic technology and algorithm to achieve a consensus

Processing of bitcoin transactions automated by servers called **miners.**

Communicate over the internet confirm transactions by **adding them to the ledger**

Blockchain is an an integrated platform
Clearing, settlement and custody rolled into one

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Value proposition of Blockchain

No Intermediary

Pseudonimous
and public

Worldwide network

Fast

Irrevocable
transactions


```
<sig> <pubKey> OP_DUP OP_HASH160
<pubKeyHash> OP_EQUALVERIFY OP_
OP_DUP OP_HASH160 <pubKeyHash>
OP_EQUALVERIFY OP_CHECKSIG
```

Script
(e.g escrow, collateral, delay)

Blockchain is a shared distributed ledger which tracks, verifies, settles and permanently renders public all transactions.

Blockchain Ecosystem in the industry

> **Awareness of DLT has grown rapidly, but significant hurdles remain to large-scale implementation**

24+ countries currently investing in DLT

2,500+ patents filed over the last **3** years

90+ corporations have joined blockchain consortia

Global interest

Research

Consortium efforts

DLT activity

Bank experimentation

Venture capital

Central banks

80% of banks predicted to initiate DLT projects by **2017**

Over **US$ 1.4 billion** in investments over the past **3** years

90+ central banks engaged in DLT discussions worldwide

Source: World Economic Forum

Blockchain Potential for financial sector

DLT on the future of financial services

- DLT has **great potential to drive simplicity and efficiency** through the establishment of new financial services infrastructure and processes

- Applications of DLT will **differ by use case**, each **leveraging the technology in different ways** for a diverse range of benefits

- **Digital Identity** is a **critical enabler** to broaden applications to new verticals

- **Digital Fiat** (legal tender), along with other emerging capabilities, has the ability to **amplify benefits**

- The most impactful DLT applications will require **deep collaboration between incumbents, innovators and regulators**, adding complexity and delaying implementation

- New financial services infrastructure built on DLT will **redraw processes** and call into question orthodoxies that are foundational to today's business models

Source: World Economic Forum

Blockchain key value drivers applying to CIB

Value Driver		Description	Use Case Example
	Operational simplification	■ DLT **reduces / eliminates manual efforts** required to perform reconciliation and resolve disputes	■ Trade Finance
	Regulatory efficiency improvement	■ DLT enables **real-time monitoring** of financial activity between regulators and regulated entities	■ Automated compliance
	Counterparty risk reduction	■ DLT challenges the need to **trust counterparties** to fulfil obligations as agreements are codified and executed in a shared, immutable environment	■ GS Settle cryptocurrency
	Clearing and settlement time reduction	■ DLT **disintermediates third parties** that support transaction verification / validation and **accelerates settlement**	■ Global payments
	Liquidity and capital improvement	■ DLT **reduces locked-in capital** and provides **transparency** into sourcing liquidity for assets	■ Asset allocation
	Fraud minimization	■ DLT enables asset provenance and full transaction history to be established within a single **source of truth**	■ Asset transfer

Source: World Economic Forum

The economist

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BNPP has positioned itself with 5 key steps in the last 5 years
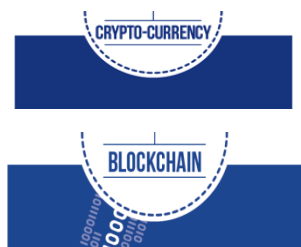
| June 2011 | June 2014 | June 2015 | Jan 2016 | Sep 2016 |

BNPP identify CC/BC

- **Bitcoin /** Blockchain topic identified and handled by R&D team
- "**Forget Currency, Think Protocol**"
- **Participants:** Evangelization with internal teams, Connection with participants, Exchange with clients

BIZ HACKATHON on Crypto Cur / 36 hours

- **40 BP2S participants**, 10 crypto-currency experts and 10 facilitators
- **Develop their knowledge** and identify the **most promising opportunities**
- **Objectives** : launching projects in 2015

BNPP Blockchain Lab

- Develop POC identified
- **Participants:** BP2S
- **Location:** Paris

- **BNPP joins : R3, CDC, DAH**

BIZ HACKATHON on Trade Finance & Cash

- 40 BNPP, 4 experts, 15 facilitators and **5 clients**
- 25 ideas and **5 POC**

BNPP Digital Therapy

- **Description:** Digital Therapy and expedition and education
- **Participants:** 500 top managers

BIZ HACKATHON Americas

- 45 BNPP, 6 experts, 4 facilitators
  5 ideas
  - Smart ABS Loans
  - CA / Ticker Chain
  - Smart Baskets
  - Smarter Liens / Receivables
  - Procurement
- **2 winners**

- **Smart basket**
- **Smarter liens**

Objective to identify, prototype, develop and commercialize usage scenarios

DLT publications of the last 9 months (some of them)

2016 The Blockchain Ecosystem

Market Insight • Proposition Development • Customer Engagement • Product Launch

FirstPartner

Introduction

The blockchain combines cryptography & distributed computing to deliver secure, direct peer to peer transactions without the need for a central party. At its heart is the Distributed Ledger. This is a tamper proof, public, network-hosted, record of all consensus verifiedtransactions.

Initially realised via Bitcoin & similar "cryptocurren-cies", focus & investment is now shifting to the potential of blockchain technology to revolution-ise the infrastructure & processes of established Financial Institutions & other enterprises.

This Map summarises the key principles behind the blockchain & the emerging ecosystem addressing payments, banking & other potential use cases.

Blockchain numbers

$921 million Cumulative VC invest-ment in Bitcoin & blockchain companies to Oct 2015. $462 million of this in 2015 alone.[1]

$121 million Largest cumulative funding total - raised by Bitcoin computer developer 21inc.[1]

805 Number of early stage Bitcoin & blockchain companies identified by Venture Scanner[2]

30+ Banks & Financial Institutions known to be testing, analysing or investing in blockchain technologies[3]

11m Number of registered Bitcoin wallets in Sept 2015 - up from 6.6m in Sept 2014[4]

106,000 Number of merchants who accept Bitcoin[4]

$4.9bn Bitcoin capitalisation Nov 2015. Bitcoin accounts for around 90% of the capital value of all cryptocurrencies[5]

$2.7bn value of Bitcoin trading in Sept 2015[6]

475 Bitcoin ATMs installed worldwide[7]

Sources:
1 CoinDesk & Crunchbase
2 Venturescanner.com reviewed Nov 2015
3 FirstPartner research
4 CoinDesk State of Bitcoin Report Q3 2015
5 Blockchain.info checked 16th Nov 2015
6 Bitcoinity.org
7 Coin ATM Radar checked Oct 2015

Author: Richard Warren rwarren@firstpartner.net

Like what you see?
Contact us for in-depth insight into your target markets!

Payment Use Cases

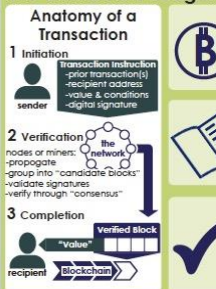| Retailing | Person 2 Person | Remittances | Financial Inclusion | Interbank Clearing | Forex | Resilience | Trading & Markets |

The Cryptocurrency Ecosystem

Specialist companies facilitating transaction validation, currency exchange, storage & payment on existing cryptocurrency newtworks (primarily Bitcoin)
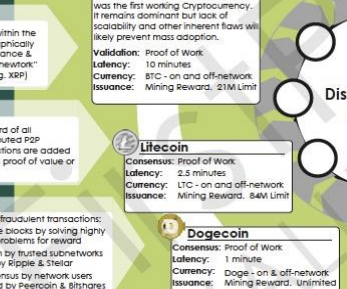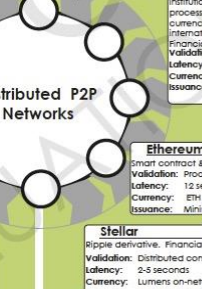
Users

Wallets
BLOCKCHAIN, xapo, ARMORY, bitreserve, case

Bitcoin Debit Cards
WageCan, ANTPRO

BitCoin ATM
LAMASSU, genesiscoin, BITACCESS

International Remittance
ABRA, BitPesa, R-BIT

Merchants

Merchant Payment Processing
PEY, DC POS

Bitcoin Processing
Bitnet, GOCOIN, bitpay

Risk & Fraud Management
vogogo

PSPs Supporting Bitcoin
PayPal, adyen, Braintree, stripe

Exchanges
BITFINEX - INVEST LIKE A PRO, kraken, LocalBitcoins.com, BITSTAMP, BTC

Multiservice Companies
coinbase, CIRCLE, BITX, BTCC, PAYMIUMI MONEY OVER IP

| | Mining | Exchange | Wallet | Processing |

Mining
Mining Technology & Commercial Operations
21 INC, KnCMiner, BitFury, spondoolies tech, HASHRABBIT, BTCS

Mining Pools
- Ghash.io
- F2Pool
- AntPool
- Slush'pool

Established Financial Ecosystem

Regulated financial instituions & platform vendors exploring blockchain technology as an alternative to centralised & correspondent payment processing

Money Transfer Operators
WESTERN UNION

Market Makers

Retail & Commercial Banks
BARCLAYS, Deutsche Bank, Bank of America, BNP PARIBAS, BBVA, citi, fidor BANK, ING, HSBC, J.P.Morgan, UBS, RBS, Santander

Central Banks & Initiatives
Liquidity Provision | National Clearing | Compliance | Policy
The following major central banks have undertaken assesments of the potential risks to financial systems and/or benefits but none yet has a definitive policy stance.
- Bank of England
- Banque de France
- Deutsche Bundesbank
- European Central Bank
- The Federal Reserve
- Monetary Authority of Singapore
- People's Bank of China
- Reserve Bank of India

Securities Markets
Nasdaq

Card Schemes
VISA, MasterCard

Interbank Networks
SWIFT, earthport

Enabling the Financial Services Blockchain

Commercial platforms & services targeting Financial Institutions

Securities & Derivatives & Asset Trading Platforms
Smart contracts & blockchain for transparent trading & post trade settlement
Mirror, symbiont, clearmatics, HEDGY, SETL

The R3 Consortium
Technology led initiative of 30+ banks to design & apply distributed ledger technology to global financial markets

Institutional Investment
TradeBlock, itBit, SolidX

Bitcoin Based Cryptocurrencies

Open Protocols for Institutions

Financial Infrastructure & APIs
Enable implementation of private Blockchains/ sidechains &/or the development & securing of financial applications
BLOCKCYPHER, eris industries, ripple, Digital Asset Holdings, Chain, Gem, Blockstack.io

The Distributed Ledger

Anatomy of a Transaction

1 Initiation
sender
Transaction Instruction
- prior transaction(s)
- recipient address
- value & conditions
- digital signature

2 Verification
the network
nodes or miners:
- propagate
- group into "candidate blocks"
- validate signatures
- verify through "consensus"

3 Completion
Verified Block
"Value"
recipient
Blockchain

Protocol Components

The Currency
The medium for transaction settlement within the network & rewarding miners. Cryptographically generated, protocol rules determine issuance & destruction. May be tradeable "off the network" (e.g. Bitcoin) or only exist on network (e.g XRP)

The Ledger
AKA the Blockchain. A Public record of all transactions - stored across a distributed P2P network of servers. Verified transactions are added in "blocks" and the history provides proof of value or assets "owned".

Consensus
Prevents "double spend" or validation of fraudulent transactions:
Proof of work: miners compete to validate blocks by solving highly processor/RAM intensive cryptographic problems for reward
Distributed consensus: majority validation by trusted subnetworks of peer nodes within the network. Used by Ripple & Stellar
Proof of stake: achieves distributed consensus by network users proving their ownership of currency. Used by Peercoin & Bitshares

Bitcoin
Created as an alternative to central bank controled fiat currencies, Bitcoin was the first working Cryptocurrency. It remains dominant but lack of scalability and other inherent flaws will likely prevent mass adoption.
Validation: Proof of Work
Latency: 10 minutes
Currency: BTC - on and off-network
Issuance: Mining Reward. 21M Limit

Litecoin
Consensus: Proof of Work
Latency: 2.5 minutes
Currency: LTC - on and off-network
Issuance: Mining Reward. 84M Limit

Dogecoin
Consensus: Proof of Work
Latency: 1 minute
Currency: Doge - on & off-network
Issuance: Mining Reward. Unlimited

Blockchain

Distributed P2P Networks

Ripple
Consensus based protocol designed specifically for existing financial institutions. Supplementing existing processes & directly suporting fiat currencies, lead use cases are international payments & inter Financial Institution settlement
Validation: Distributed consensus
Latency: 3 seconds
Currency: XRP on-network only
Issuance: At inception -100 BN units created.

Ethereum
Smart contract & distributed app focus
Validation: Proof of Work
Latency: 12 seconds
Currency: ETH on-network only
Issuance: Mining Reward.

Stellar
Ripple derivative. Financial focus
Validation: Distributed consensus
Latency: 2-5 seconds
Currency: Lumens on-network only
Issuance: 100 BN then 1% issued PA.

Crypto 2.0 - Building on the Bockchain

Smart Contracts
Encode & validate "conditions" for a transaction between parties. Potentially facilitate legally binding transactions over the blockchain
consensys, CLEARINGHOUSE, Counterparty, CODIUS

Colored Coins & Open Assets
Bitcoins altered to represent an asset. Exchanged via the Open Assets Protocol. Allows trading of physical & other assets
colu, coinprism, ChromaWay, Omni

Core Blockchain Protocols
bitcoin, stellar, ripple, DASH, ethereum, Peercoin, VIACOIN

Protocol Commercialisation
Consensys: building an Ethereum based ecosystem & partnered with Microsoft for Ethereum Blockchain as a Service
Ripple: facilitating multiple Financial Institutions focussing on payment solutions

Enabling Layers
Protocols, platforms & SDKs that build on top of core blockchain protocols to enable additional transaction types & services

Other Use Cases

IBM, FILAMENT, factom, SAMSUNG, MaidSafe, STORJ.io, ShoCard, stampery, Bitproof.io

lighthouse, OpenBazaar, La'Zooz, BLOCKPARTI, ALEXANDRIA, BISANTYUM

| IoT | Data | e-Identity | Legal | Crowd Funding | Market Places | Publishing | Proof of Ownership |
| Registering and validating connected devices | Distributed storage of and access to business data | Registering and validating individual identity | Executing smart legal contracts | Raising finance & distribut-ing equity | Trading & sharing of physical & digital assets & services | Digital asset rights manage-ment, distribution & payment | Tamper proof registration & "stamping" of physical & digital assets |

Balancing the Benefits

Blockchain Benefits
- Ecosystem simplification
- Faster interbank clearing & settlement
- Lower transaction costs
- Reduced counterparty risk
- Transparency & auditability
- Ease of software development/integration

Vs.

Risks
- Unproven technology
- Untested capacity/scalability
- Low transaction speed
- Possible dangerous protocol flaws
- Cryptocurrency price volatility
- Uncertain regulatory status

Data & Analytics
COINALYTICS, blockr, KAIKO, BLOCKCORP, bitcoin charts

Key Security/HSMs
gemalto, THALES

Investors
ANDREESSEN HOROWITZ, overstock, LIGHTSPEED VENTURE PARTNERS, DIGITAL CURRENCY GROUP, BLOCKCHAIN, Google ventures, AME CLOUD VENTURES, PANTERA

Overview of ecosystem

Public blockchain & crypto currencies	Startups (> 5m€)	Awareness clubs Consortium	Finance Industry (incubators, dedicated teams and initiatives)
20+ networks & currencies with a cap > USD 5m	**130** Startups raised private capital >$1bn in total	**C10+**	**c40+**

Public blockchain & crypto currencies:
- Bitcoin — 5B$
- ethereum — 700m$
- ripple — 274m$
- litecoin — 150m$
- MaidSafe — 44m$
- (nem) — 6m$

Startups:
- Digital Asset Holdings — >$50m
- rippleLabs — $41m
- Chain — $30m
- SETL.io
- clearmatics
- t0
- Tembusu Systems
- …

Awareness clubs Consortium:
- R3 / CV — 42 Banks ++
- LINUX FOUNDATION — Share code
- 30 Members
- LaBChain — 15 Members
- Free 9 banks
- London Stock Exchange

Finance Industry:
- BARCLAYS — innovation blockchain lab in London — Three Blockchain Startups selected for Barclays Accelerator
- Nasdaq — Enhance the equity management capabilities offered by its Nasdaq Private Market platform
- LONG FINANCE — InterChainZ: Distributed Ledger Technology Applied To Financial Services
- UBS
- SWIFT
- BNP PARIBAS
- BNY MELLON

BNPP has positioned itself in various leading global initiatives, with 4 key partnerships / investments in the last 5 months

Nov 20, 2015 — **Dec 16, 2015** — **Jan 21, 2016** — **Apr 2016** — **Sep 2016**

BNPP joins the R3 Consortium

- **Description:** Blockchain consortium around R3 start-up
- **Participants:** 42 banks currently taking part in the project /
- 60+ Insurance, Thomson….
- **Location:** New-York
- **BNPP representation:** P. Denis

Participants:

BNPP joins the LaBChain

- **Description:** French innovation laboratory (6 months)
- **Participants:** 11 partners (banks, insurances, start-ups, associations)
- **Location:** Paris
- **BNPP representation:** P. Denis

Participants :

BNPP invests in (DAH)

- **Description:** FinTech start-up specialized on Blockchain technology
- **Participants:** 15 investors,
- **Location:** New-York
- **BNPP representation:** 1 Board seat granted C. Flax

BNPP partnership with Crowd Funding partners

- **Description: Crowd Funding**

- Crowd equity
- Crowd Lending Oct 2016 Minibons / Bon de caisse

- **Location:** Paris

Objective to develop, prototype and commercialize usage scenarios

BNPP Analysis of R3, DAH and Hyperledger

- **Description:** Blockchain consortium around R3 start-up
- **Participants:** 42 banks currently taking part in the project up to 60+ institutions today

- **Description:** FinTech start-up specialized on Blockchain technology
- **Participants:** 15 investors, incl. banks, markets and post-trade specialists

- The Hyperledger Project is a collaborative effort created to advance blockchain technology by identifying and addressing important features for a cross-industry open standard for distributed ledgers that can transform the way business transactions are conducted globally.

Objective to develop, prototype and commercialize usage scenarios

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DLT Strategy Comparison

	Protocol	Collaborative Lab	Business Products	Market Place
	Corda	• 6 finished, • 26 in execution • 18 in incubation	■ Derivatives ■ Trade Finance ■ KYC AML	
Digital Asset Holdings	**Hyperledger**	■ ASX ■ Syndicated Loans ■ Treasury Repos	■ ASX	■ TBD
NXT NXT GENERATION OF CRYPTOCURRENCY	**NXT**	■ Open source code		
HYPERLEDGER PROJECT	**Hyperledger**	■ Open Source code (Linux foundation)		
ethereum	**Ethereum**	■ Open Source code		

Industry bodies contemplating on DLT technology

BAFT
stands for
Bankers Association for Finance and Trade
Abbreviations.com

SWIFT
stands for
Society For Worldwide Interbank Financial Telecommunications
Abbreviations.com

MAS
stands for
Monetary Authority of Singapore
Abbreviations.com

FBF
stands for
French Banking Federation
Abbreviations.com

ISSA
stands for
International Securities Services Association
Abbreviations.com

ESMA
stands for
European Securities and Markets Authority
Abbreviations.com

FISMA
stands for
Federal Information Security Management Act
Abbreviations.com

MEDEF

LSE
stands for
London Stock Exchange
Abbreviations.com

Blockchain Lab Academics Collaboration

Institut Louis Bachelier

Impact of Blockchain on financial & insurance sectors

What if the the blockchain is successful impact on 2030 and beyond ?

Paristech Mines Telecom

Research Chaire Institut Mines Telecom: Values & Politics of personal information

Launching a BC stream in 2017

Academics Collaboration

Sia Partners

Universities Blockchain Challenge

2017 one year challenge (Fin/Energy/Free)
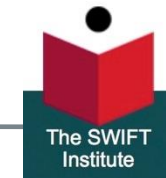
SWIFT institute

Modelling langage des DLT (CORDA, Ethereum et Hyperledger …) / ISO 20022 (info data exchange)

Leverage on our expertise with academics

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CTTS – Blockchain Projects

May	June	July

CWB	Collat'Shaker		SmartLC

Cash without borders	**Use Blockchain to transfer cash in real time within BNP Paribas** ▪ POC1 developed ▪ Connection with legacy systems and testing clients planned for September
Smart LC	**Trade product suite (LC / Guarantees / collections) improved by using smart contracts on Blockchain** ▪ POC1 development
Collat' Shaker	**Better manage collateral by using smart contracts on the Blockchain** (pricing / trigger margin calls) ▪ POC1 developed ▪ Client tests planned

CASH WITHOUT BORDERS

SMART LC

COLLAT' SHAKER

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Blockchain: Registry for unlisted companies

2016

CROWD FUNDING ON BLOCKCHAIN

Blockchain: Registry for unlisted companies

| Challenge	Inefficiencies limit funding for start-ups Processing crowdfunding payments can take several days (or longer). Investments are illiquid.
Solution	BNP Paribas is building a primary market registry for private companies that raise money via crowdfunding platforms. The standardisation and enhanced security will support secondary trading.
Benefits	■ Speed, reduced counterparty risk: Process is integrated from issuance to settlement. Payments are handled immediately and e-certificates issued instantly. ■ Simplicity, low cost: Custody and recordkeeping are simple and inexpensive. ■ Liquidity: Together, speed, security and efficiency help to make the investments more liquid (benefitting both issuers and investors).
Status	Pilot programme is due to launch in late 2016 with crowdfunding specialists Smart Angels, Lendosphere, Enerfip and Lumo, subject to regulatory approvals.

Challenges

- While the technology is very promising and initiatives are popping up everywhere, challenges will need to be overcome to deliver on these promises, such as :

    - **Technology still in infancy** (stability of protocols, scalability, reliability, interoperability, public versus private, permissioned versus permission less, consensus, integration with legacy systems, distributed privacy…).

    - **Identity framework**

    - **Regulatory landscape**

    - **Legal implications**

    - Ability of different players and regulators to **continue to cooperate** beyond POC to play

The way to DLT….

VISION   **TEAM**   **BUDGET**   **CONSISTENCY**
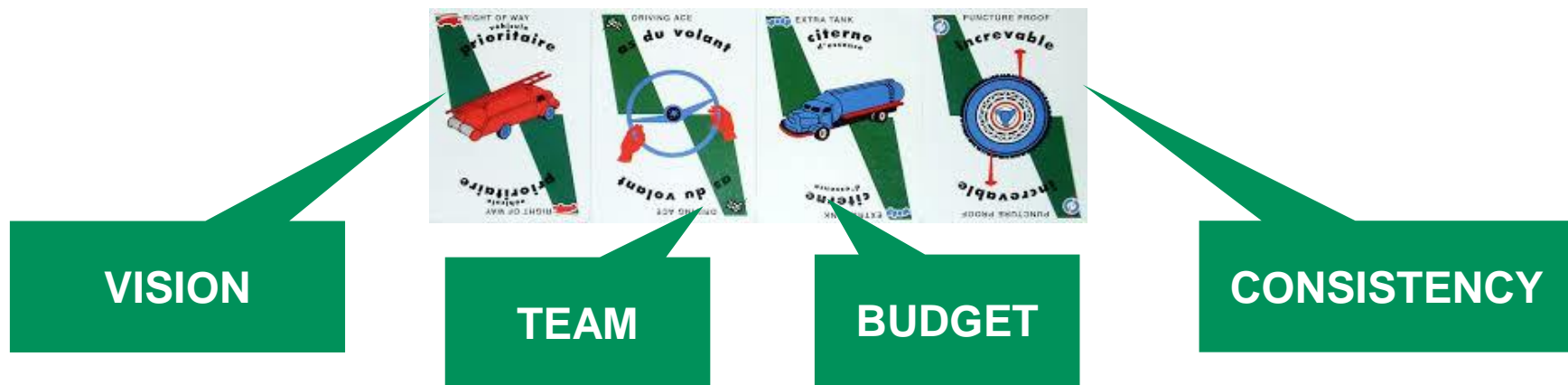
– Set the **vision and identify big picture**

– **Disruptive**
  • DLT solutions is not a commodity (not done before)
  • Packages do not exist and cannot be implemented (new culture)
  • DLT world is a very rich, dangerous and competitive place (speed)

– **Transversality and collaboration** is key

– **Shorten the 6 years percolation theory** through new ways of thinking

Three waves and the next one…

BitCoin

Blockchain

Distributed Ledger Technology

Identity & Distributed Privacy

Three waves and the next one…