Bitcoin and Cryptocurrencies

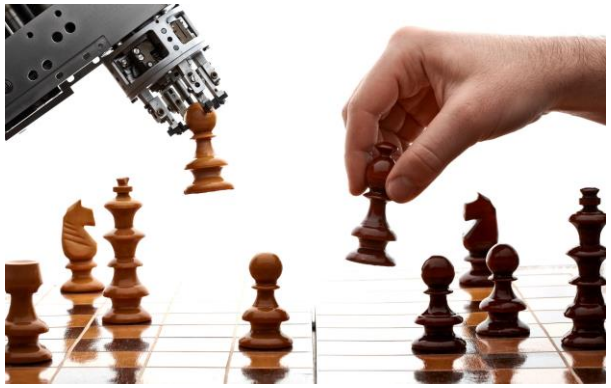
- Lecture 6: Ethereum & Smart Contracts: Enabling a Decentralized Future
- Professor Radjabov Mukhammad

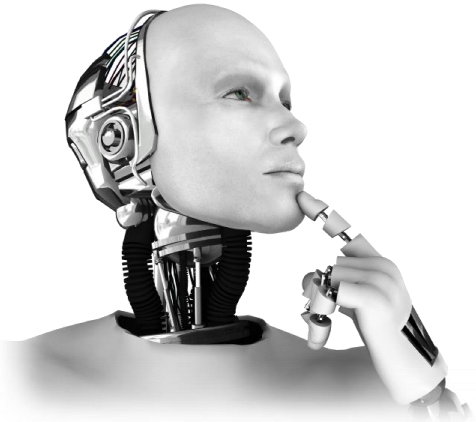
What is intelligence?

- There is no exact definition of intelligence. It is controversial and psychologists have debated over such definition for a long time
- Some of the properties that contribute to intelligence, and hence maybe used as part of its definition include:
  - Ability to deal with new situations
  - Ability to solve problems
  - Ability to answer questions
  - Ability to devise plans
  - Ability to learn new things and adapt them to what is already known
  - Etc.

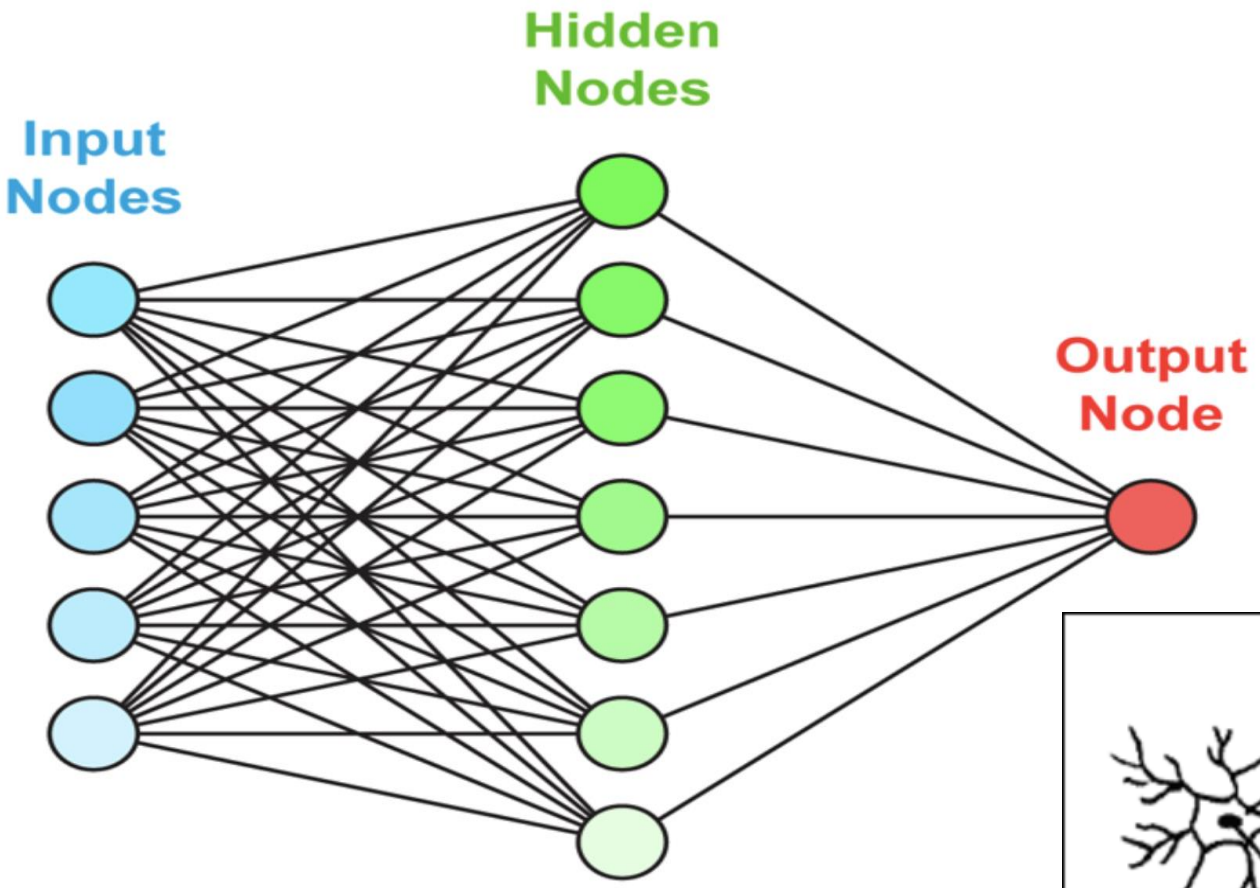
What is artificial intelligence?

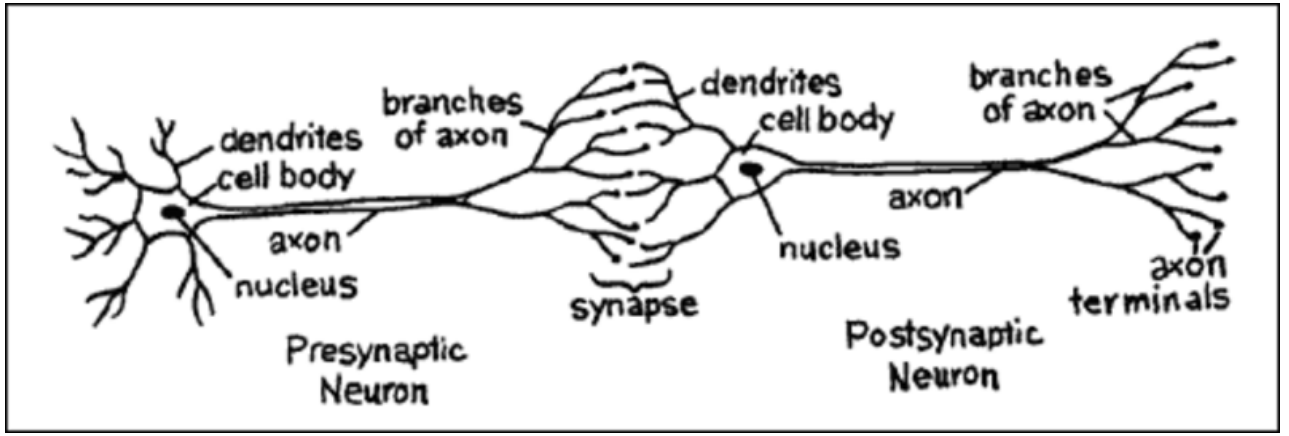
- Simulation of intelligence properties in machines
- The science of making intelligent machines through intelligent software
- The study and making of machines that mimic human thinking and goes beyond what humans are capable of doing
- Ability to use massive computing power to address certain situations, predict what might happen, and proactively do something about it



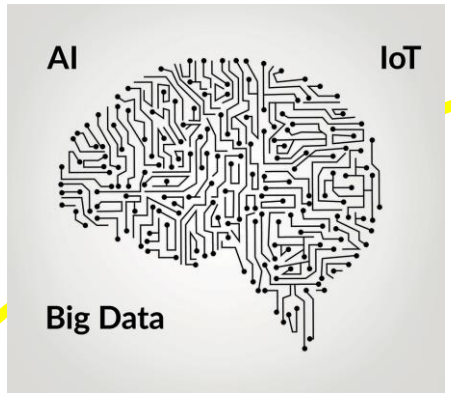


Neural networks





Computing evolution



1995

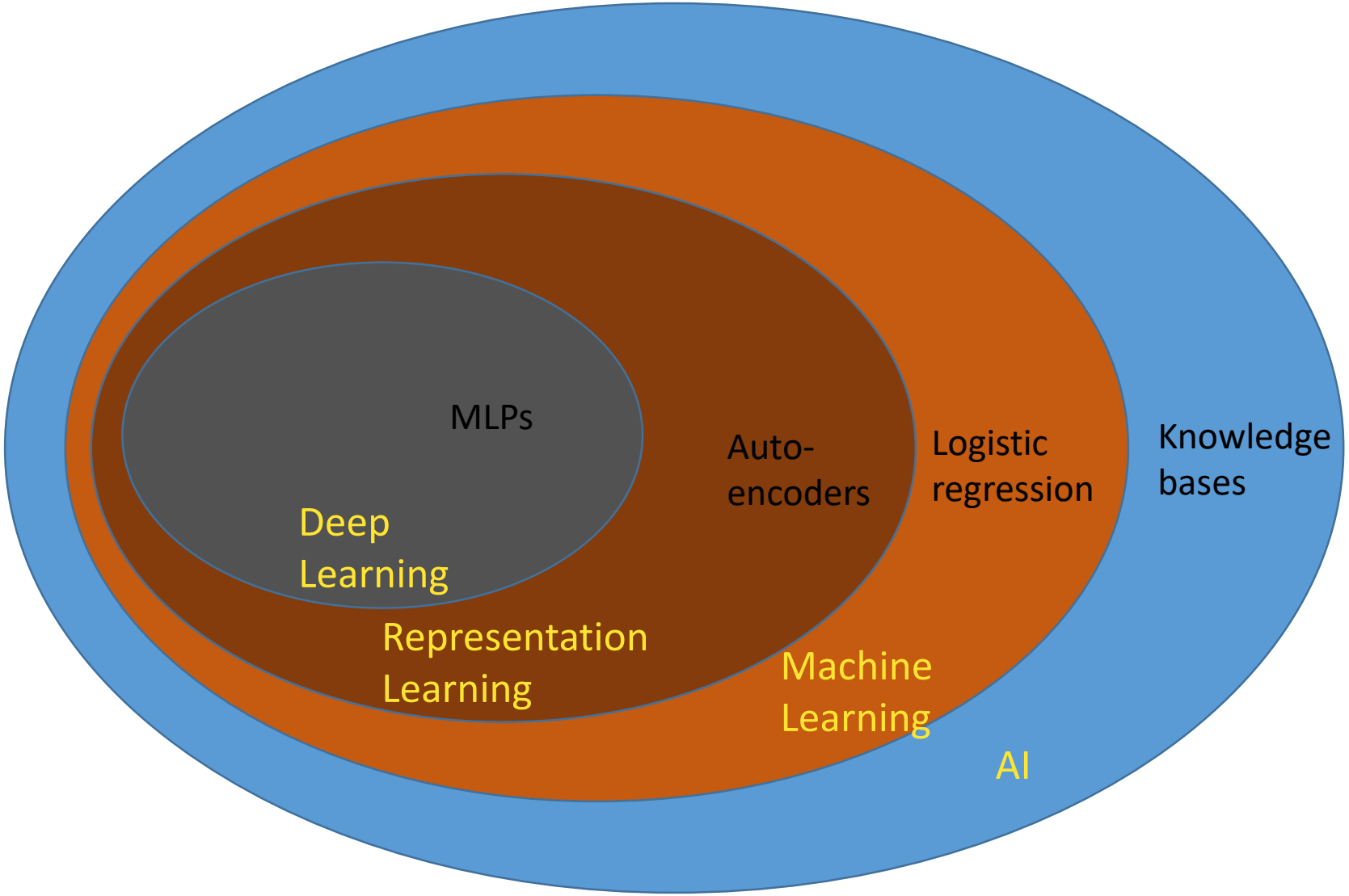
2007

2015

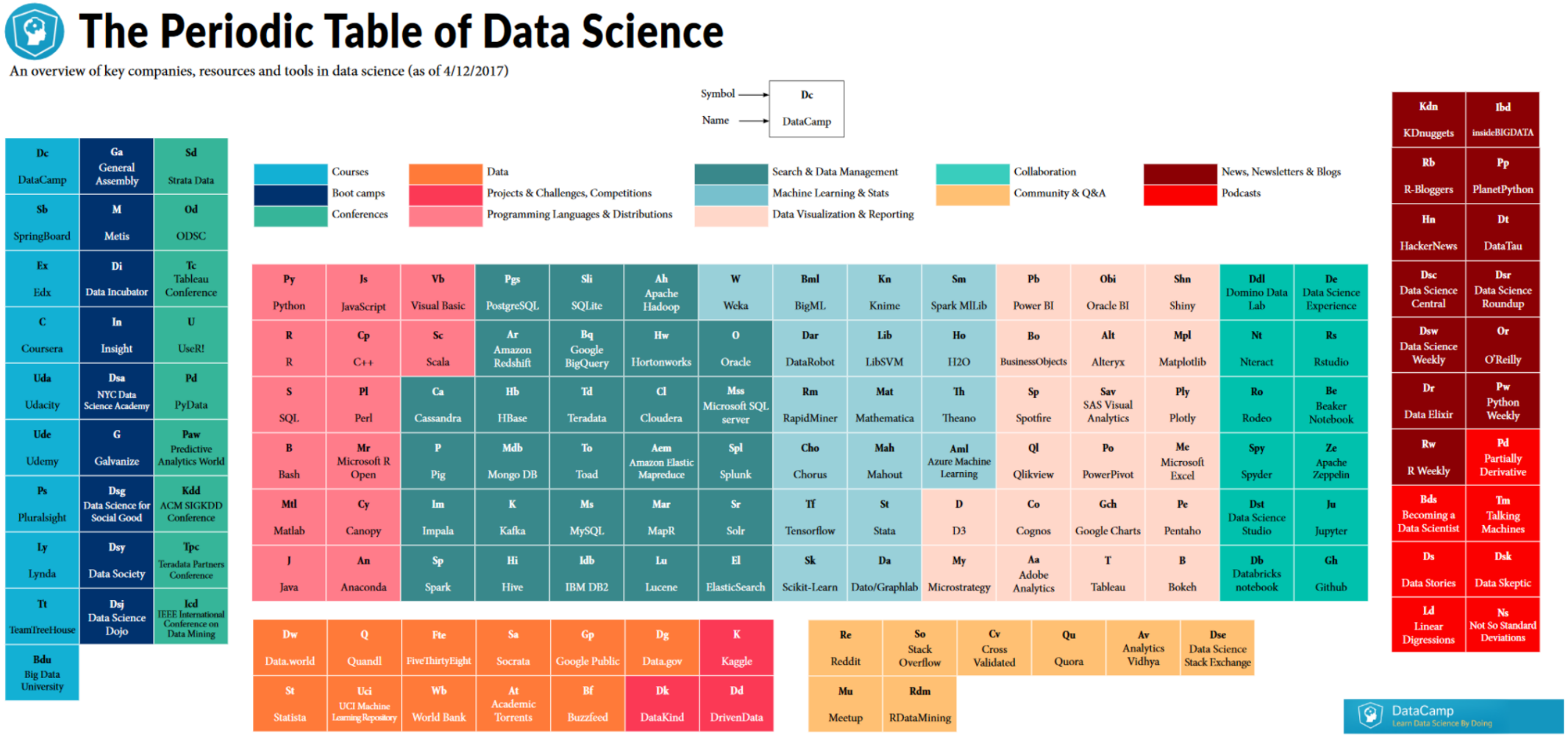
Examples of AI applications

- Computer vision
- Speech recognition
- Deep learning
- Chatbots
- Sensor processing
- Natural language processing
- Knowledge representation
- Image recognition
- Machine learning
- Virtual agent
- Autonomics
- Video games
- Automated reasoning
- And more…

From AI to deep learning



The periodic table of data science



Source: https://s3.amazonaws.com/assets.datacamp.com/blog_assets/Data-Science-Periodic-Table.pdf


UBER
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What's up with the blockchain hype?

- Largely based on well-established and understood technologies:
  - Crypto,
  - distributed databases and networks,
  - peer-to-peer,
  - discovery and network protocols, etc.
- It's the composite of these technologies that creates the big deal and disruption across all industries (started in financial services)
- Initial designs (bitcoin) proved to be resilient
- Smart contracts showed the real potential for blockchain in not only securely transfer value, but also create future binding contracts in a trustless environment

Blockchain pillars

- Authenticity (cryptographic): creates transactions that are impervious to fraud through the use of public/private signatures establishing a shared truth
- Shared: the more companies participating in the blockchain the more value it brings
- Distributed: many replicas of the blockchain database making it more authentic
- Ledger: read/write once database maintaining an immutable record of every transaction

Blockchain network types

- Public (trustless/POW mining)
  - Bitcoins
  - Ethereum
  - n-Crypto-currency network

- Private (semi-trusted, consensus algos)
  - Ethereum
  - Enterprise ethereum (quorum)
  - Hyperledge – fabric
  - Chain
  - Corda – distributed ledger

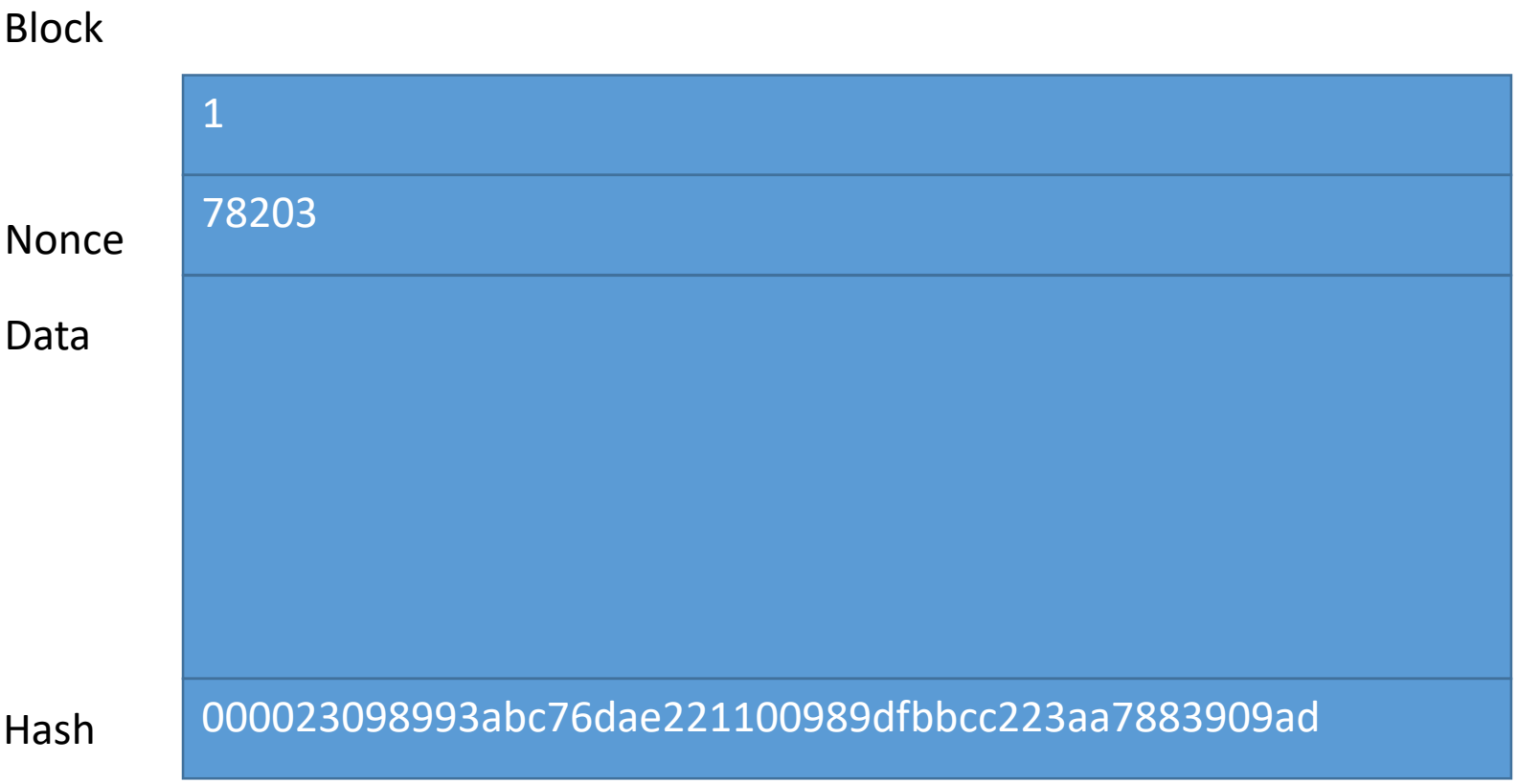
Disruptive effect of blockchain

- Flatten ecosystem and supply chain removing middleman processes
- Peer-to-peer value exchange reducing settlement time in a dramatic way
- Change audit at the DNA level – one ledger instead of comparing multiple ledgers
- More collaborative economy – shared costs, risks, etc.
- Dramatic changes in how identity is defined and controlled

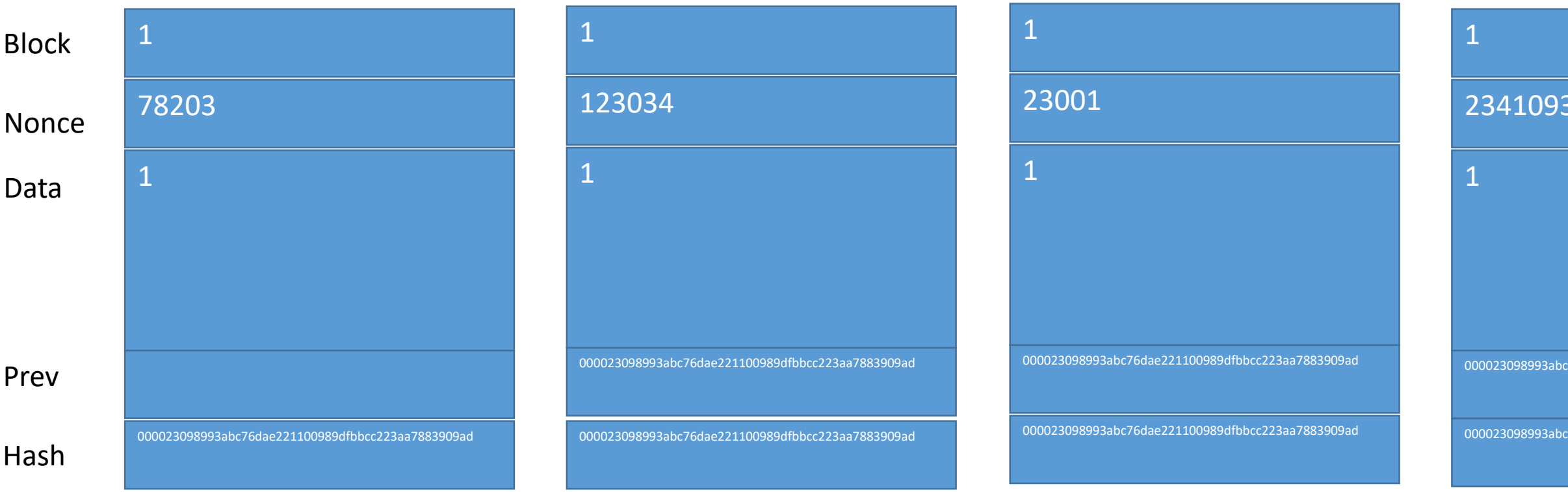
Blockchain explained - Hash

SHA256 Hash

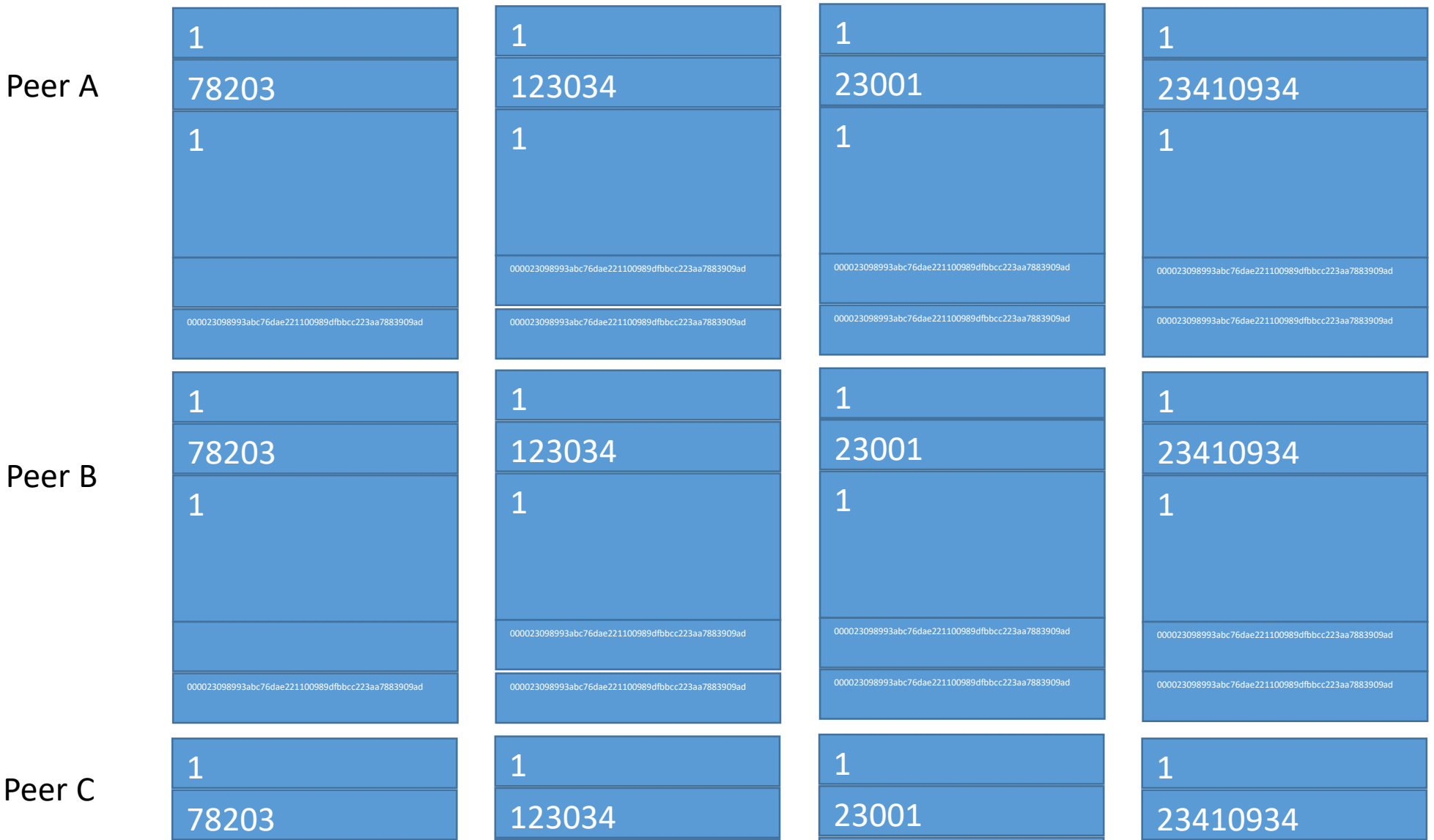
Blockchain explained - Block



Blockchain explained - Blockchain



Blockchain explained - Peer

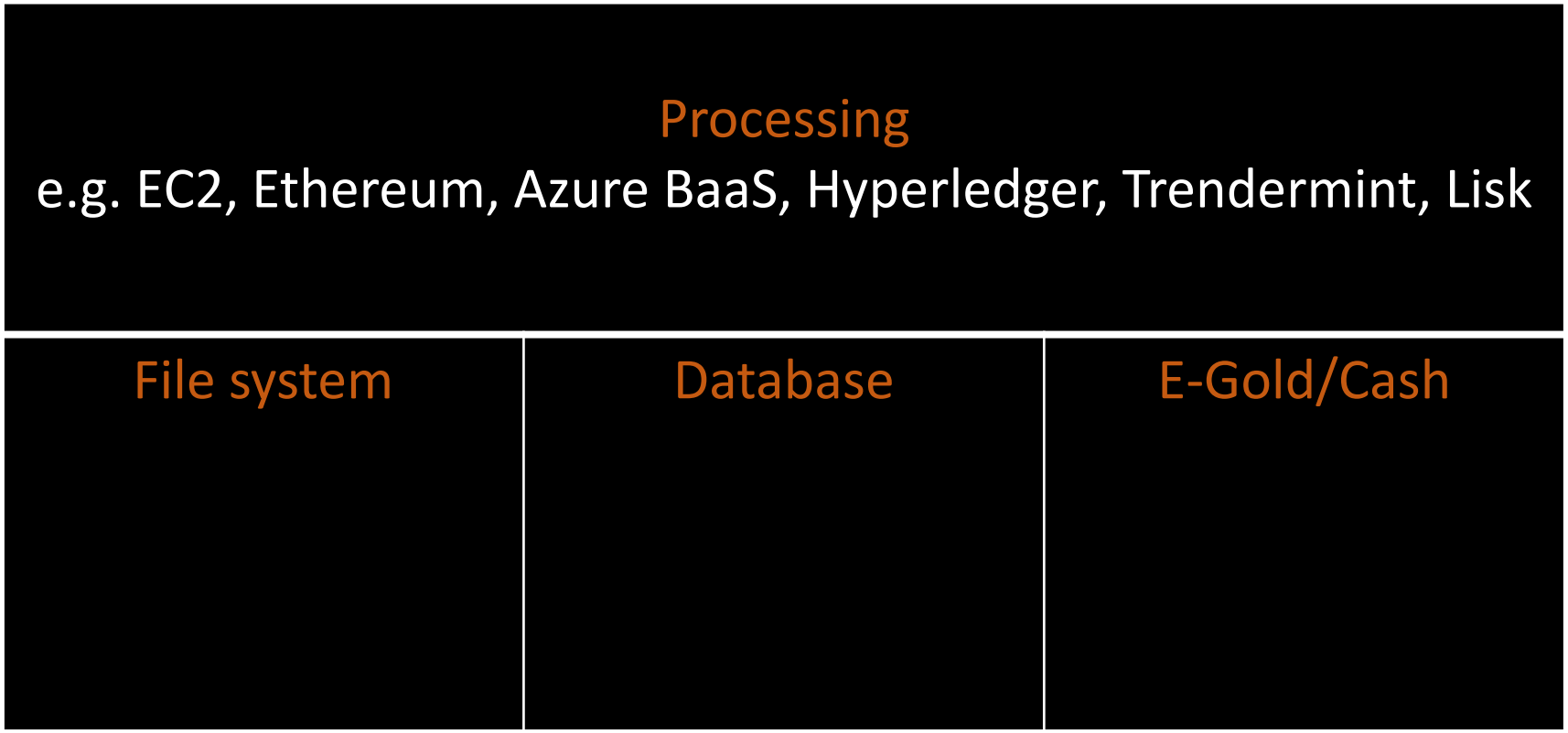


Adding meaning to a block – token and coinbase

Block	1			
Coinbase	**$**	**100**	**→**	**Sam**
Nonce	78203			
Data	**$**	**20**	**from**	**Sam**	**→**	**Karen**
	$	10	from	Karen	→	Joe
	$	5	from	Sam	→	Janet
	$	15	from	Sam	→	Rick
Hash	000023098993abc76dae221100989dfbbcc223aa7883909ad					

https://github.com/anders94/blockchain-demo

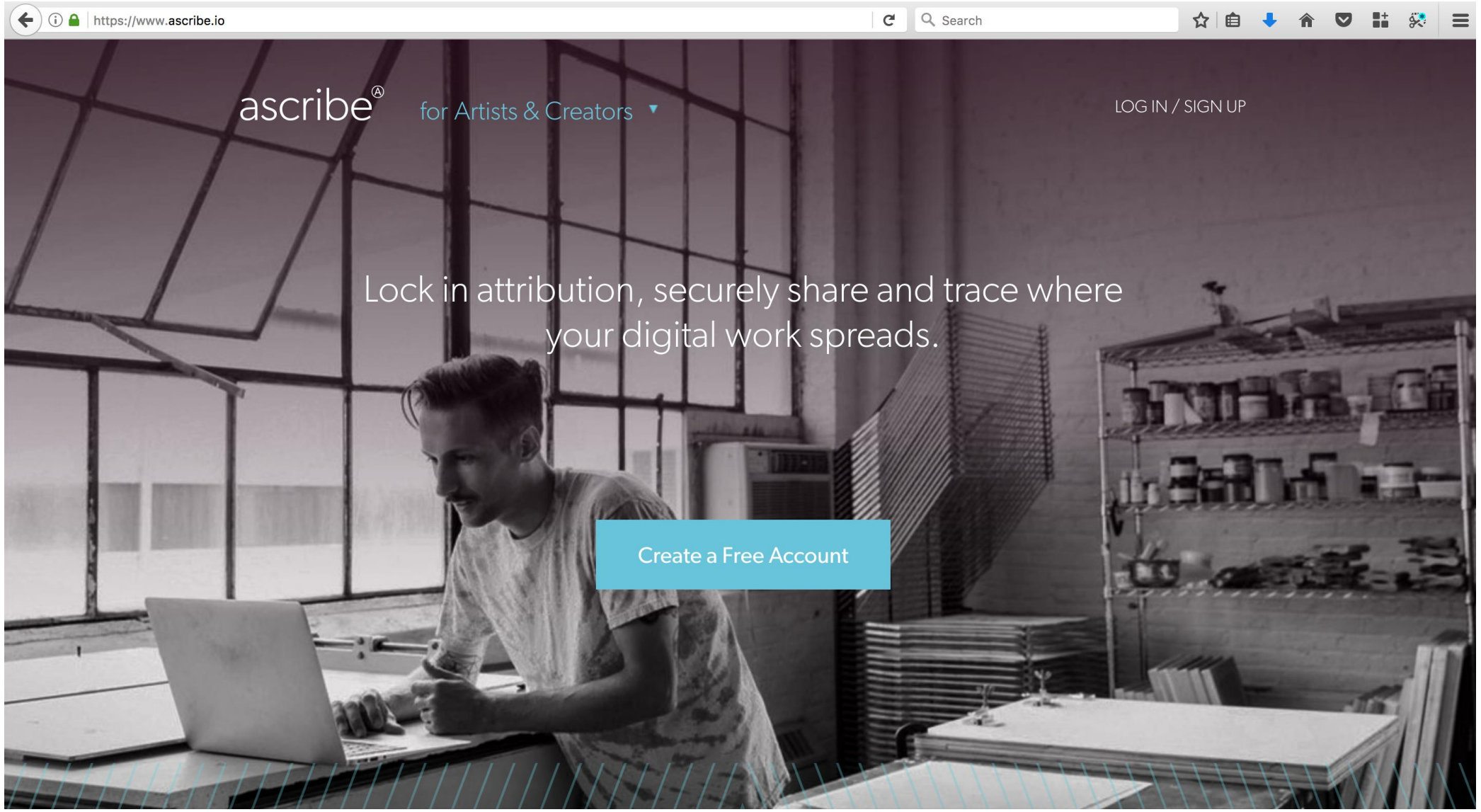
The emerging decentralized stack



Blockchain databases

- Start with an enterprise grade database, such as MongoDB
- Engineer the database to blockchain characteristics:
  - Decentralized/shared control: each database node is a federation node
  - Immutable/audit trail: hash previous block, append only
  - Native assets: “own” = have private key, asset lives on the database

Real-life example



AI and blockchain

- Blockchain from AI perspective:
  - Open data for machine learning
  - AI data exchange in trustless environments
  - AI evolution towards human AI
- AI from blockchain perspective:
  - Economical agents
  - Data consumers
  - Data producers
  - Minors (proof of cognitive work)

How does blockchain help AI?

- Decentralized/shared control encourages data sharing leading to even more data available to make AI models better
- Qualitatively new ecosystem-level data → qualitatively new models
- Immutability for an audit trail on training/testing data and models. This leads to more trustworthiness of data and models
- An opportunity to create a global registry for training data and models where they become IP assets in a decentralized repository and exchange
- Selling the assets on the exchange will accumulate wealth and cannot be stopped

AI and blockchain

- Today:
  - Financial transactions – no more banks, credit cards, etc. (bitcoin, ripple, dash)
  - Smart contracts
  - GovTech open civic data (e-auction)
- Tomorrow:
  - Energy consumption
  - Good transportation
  - Legal records
  - Smart city data
  - Autonomous vehicle data
  - Etc.

Tax treatment

- 2014 IRS guidance
- Transactions to and from virtual currencies may create taxable events
- Gains and losses may be ordinary income or capital income

Anti-Money Laundering (Section 7.6)

- goal of AML: stop large amounts of money from

- (1) crossing borders, or
- (2) moving from underground to legitimate economy

- without detection

Know Your Customer (KYC):

(1) identify and authenticate clients,
(2) evaluate risk of client,
(3) watch for anomalous behavior.

Mandatory reporting in U.S.:

Must report currency transactions over $10,000.
⇒ file “currency transaction report”

Must watch for clients “structuring” transactions to avoid reporting.
⇒ file “suspicious activity report”

Requirements differ by country; consult your lawyer.

Note well: government takes this very seriously!

Bitcoin businesses have been shut down.

Businesspeople have been arrested.

Reference

- The Bitcoin Standard: The Decentralized Alternative to Central Banking – Illustrated, April 24, 2018 by Saifedean Ammous
- The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them (Cryptography, Crypto Trading, Derivatives, Digital Assets) – Illustrated, September 15, 2018 by Antony Lewis (Author)
- Blockchain Bubble or Revolution: The Future of Bitcoin, Blockchains, and Cryptocurrencies – June 12, 2019 by Neel Mehta (Author), Aditya Agashe (Author), Parth Detroja (Author)
- Cryptocurrency Investing For Dummies – March 6, 2019 by Kiana Danial
- Cryptocurrency Mining For Dummies– Illustrated, December 5, 2019 by Peter Kent
- Cryptocurrency Mining: A Complete Beginners Guide to Mining Cryptocurrencies, Including Bitcoin, Litecoin, Ethereum, Altcoin, Monero, and Others – February 21, 2018 by Crypto Tech Academy (Author)