

Bitcoin and Cryptocurrencies

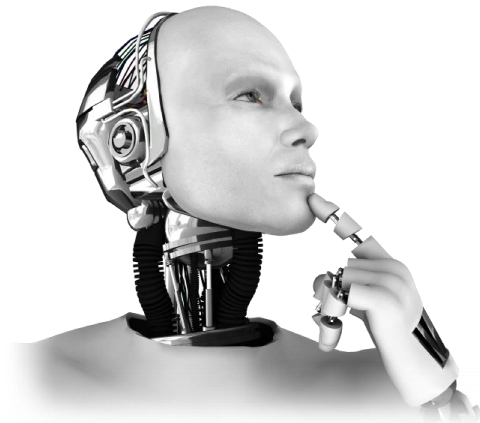
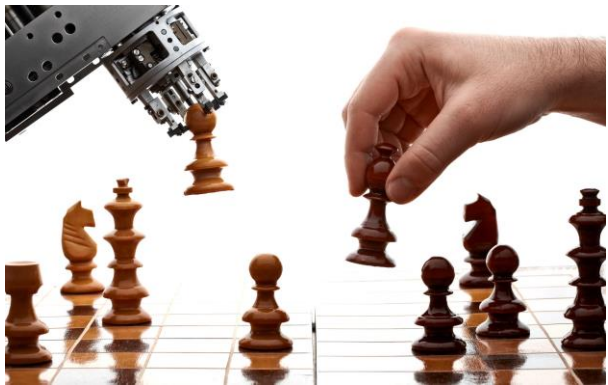
- Lecture 6: Ethereum & Smart Contracts: Enabling a Decentralized Future
- Professor Radjabov Mukhammad

What is intelligence?

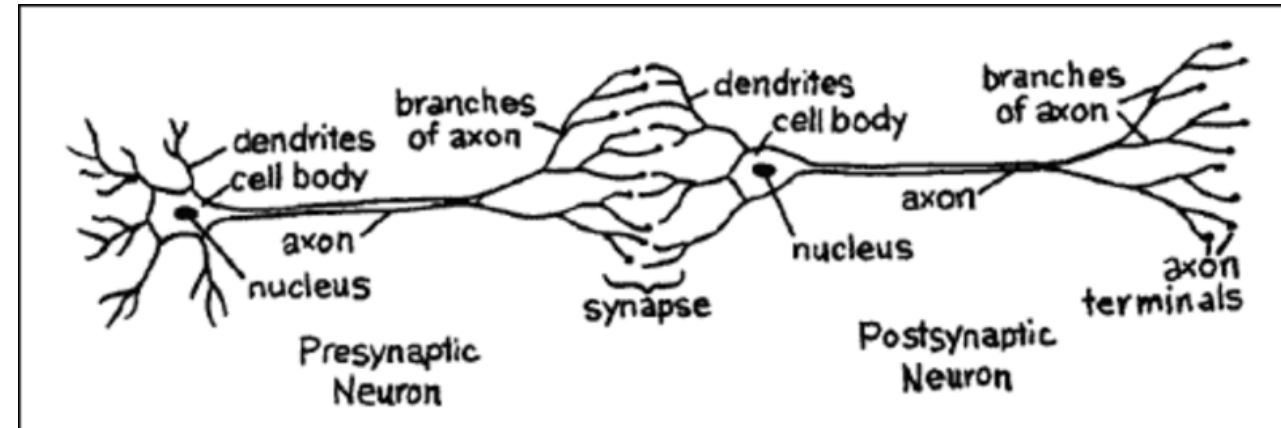
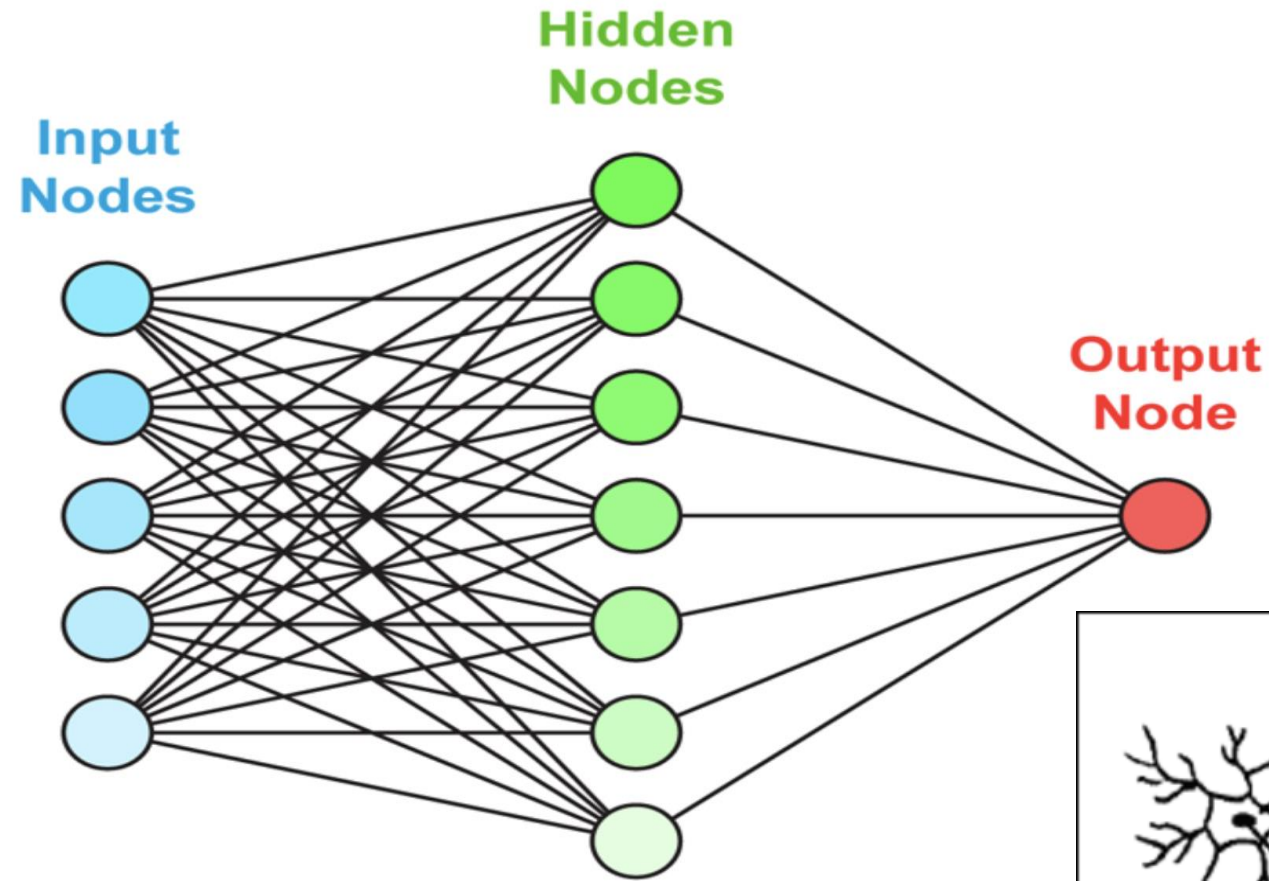
- There is no exact definition of intelligence. It is controversial and psychologists have debated over such definition for a long time
- Some of the properties that contribute to intelligence, and hence maybe used as part of its definition include:
 - Ability to deal with new situations
 - Ability to 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



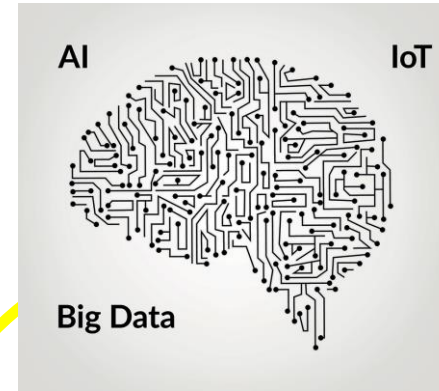
Computing evolution



1995



2007



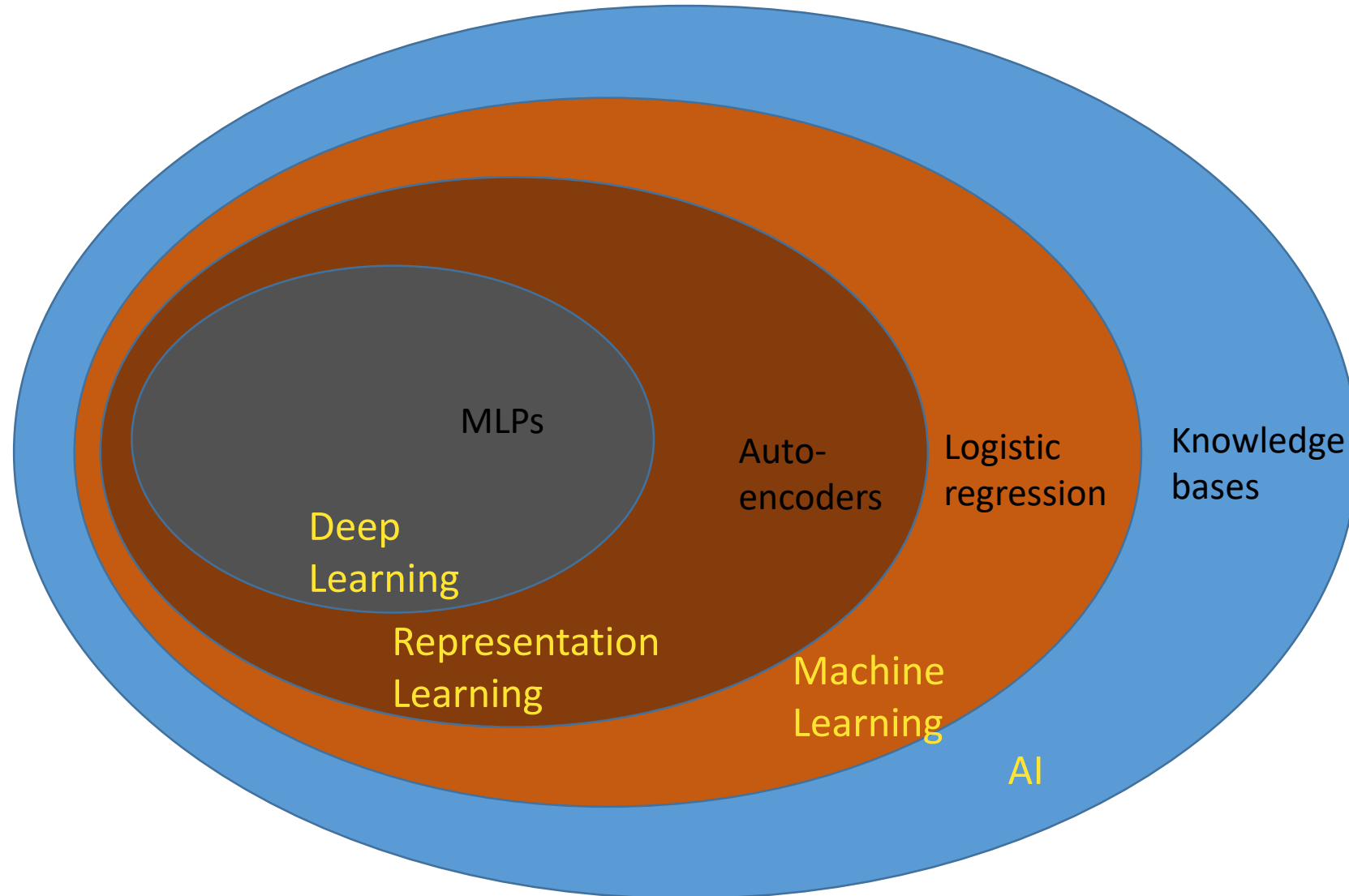
2015



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



The Periodic Table of Data Science

An overview of key companies, resources and tools in data science (as of 4/12/2017)



 Courses	 Data	 Search & Data Management	 Collaboration	 News, Newsletters & Blogs
 Boot camps	 Projects & Challenges, Competitions	 Machine Learning & Stats	 Community & Q&A	 Podcasts
 Conferences	 Programming Languages & Distributions	 Data Visualization & Reporting		

Dc DataCamp	Ga General Assembly	Sd Strata Data
Sb SpringBoard	M Metis	Od ODSC
Ex Edx	Di Data Incubator	Tc Tableau Conference
C Coursera	In Insight	U Useful
Uda Udacity	Dsa NYC Data Science Academy	Pd PyData
Ude Udemy	G Galvanize	Paw Predictive Analytics World
Ps Pluralsight	Dsg Data Science for Social Good	Kdd ACM SIGKDD Conference
Ly Lynda	Dsy Data Society	Tpc Teradata Partners Conference
Tt TeamTreeHouse	Dsj Data Science Dojo	Icd IEEE International Conference on Data Mining
Bdu Big Data University		

Py Python	Js JavaScript	Vb Visual Basic	Pgs PostgreSQL	Sli SQLite	Ah Apache Hadoop	W Weka	Bml BigML	Kn Knome	Sm Spark MLlib	Pb Power BI	Obi Oracle BI	Shn Shiny	Ddl Domino Data Lab	De Data Science Experience
R R	Cp C++	Sc Scala	Ar Amazon Redshift	Bq Google BigQuery	Hw Hortonworks	O Oracle	Dar DataRobot	Lib LibSVM	Ho H2O	Bo BusinessObjects	Alt Alteryx	Mpl Matplotlib	Nt Nteract	Rs Rstudio
S SQL	Pl Perl	Ca Cassandra	Hb HBase	Td Teradata	Cl Cloudera	Mss Microsoft SQL server	Rm RapidMiner	Mat Mathematica	Th Theano	Sp Spotfire	Sav SAS Visual Analytics	Ply Plotly	Ro Rodeo	Be Beaker Notebook
B Bash	Mr Microsoft R Open	P Pig	Mdb Mongo DB	To Toad	Aem Amazon Elastic Mapreduce	Spl Splunk	Cho Chorus	Mah Mahout	Aml Azure Machine Learning	Ql Qlikview	Po PowerPivot	Me Microsoft Excel	Spy Spyder	Ze Apache Zeppelin
Mtl Matlab	Cy Canopy	Im Impala	K Kafka	Ms MySQL	Mar MapR	Sr Solr	Tf Tensorflow	St Stata	D D3	Co Cognos	Gch Google Charts	Pe Pentaho	Dst Data Science Studio	Ju Jupyter
J Java	An Anaconda	Sp Spark	Hi Hive	Idb IBM DB2	Lu Lucene	El ElasticSearch	Sk Scikit-Learn	Da Dato/Graphlab	My Microstrategy	Aa Adobe Analytics	T Tableau	B Bokeh	Db Databricks notebook	Gh Github

Dw Data.world	Q Quandl	Pte FiveThirtyEight	Sa Socrata	Gp Google Public	Dg Data.gov	K Kaggle	Re Reddit	So Stack Overflow	Cv Cross Validated	Qu Quora	Av Analytics Vidhya	Dse Data Science Stack Exchange
St Statista	Uci UCI Machine Learning Repository	Wb World Bank	At Academic Torrents	Bf Buzzfeed	Dk DataKind	Dd DrivenData	Mu Meetup	Rdm RDataMining				

Kdn KDnuggets	Ibd insideBIGDATA
Rb R-Bloggers	Pp PlanetPython
Hn HackerNews	Dt DataTau
Dsc Data Science Central	Dsr Data Science Roundup
Dsw Data Science Weekly	Or O'Reilly
Dr Data Elixir	Pw Python Weekly
Rw R Weekly	Pd Partially Derivative
Bds Becoming a Data Scientist	Tm Talking Machines
Ds Data Stories	Dsk Data Skeptic
Ld Linear Digressions	Ns Not So Standard Deviations



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



RoboEarth.org/Bart van Overbeeke



FREIGHTLINES



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

Block

1

Nonce

78203

Data

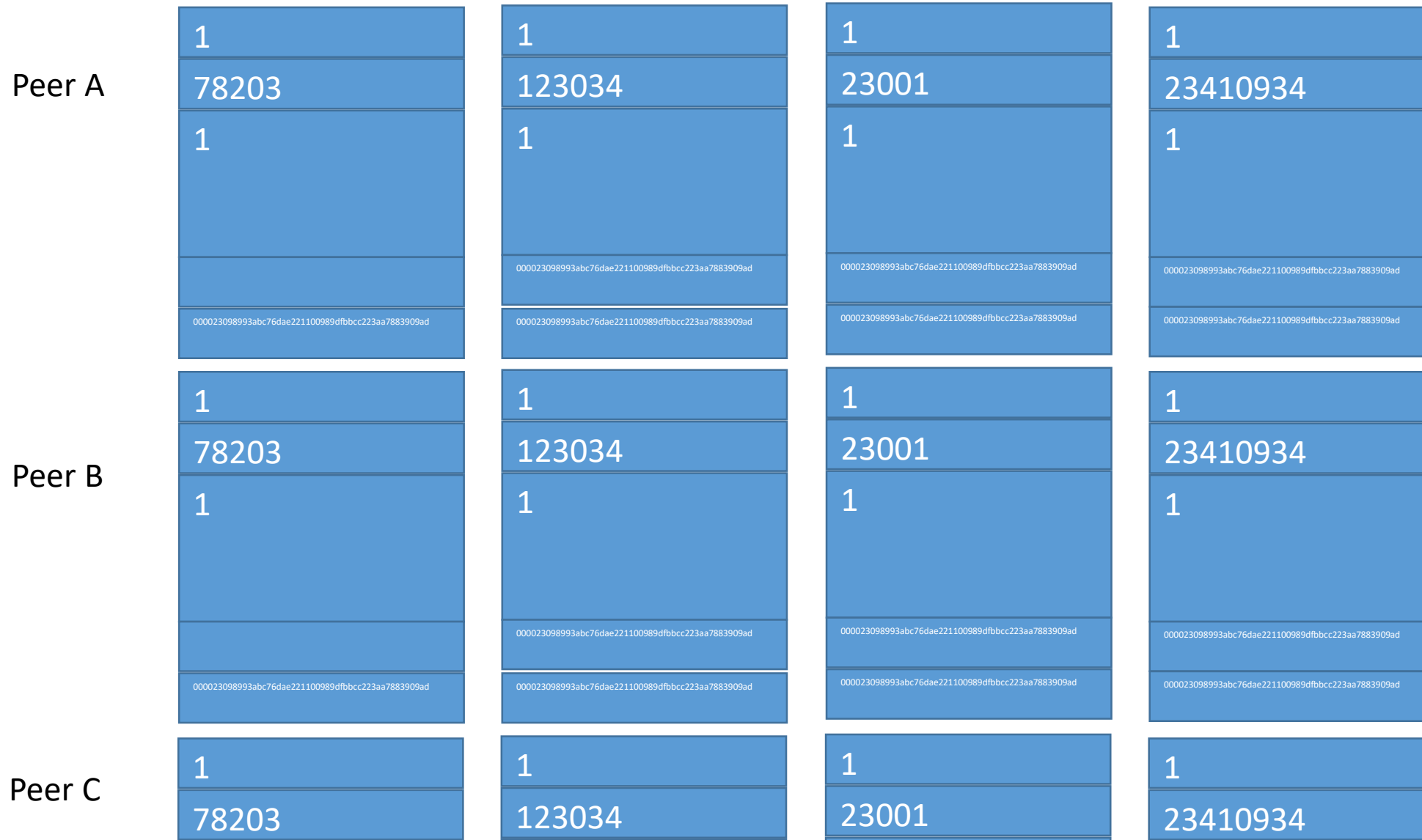
Hash

000023098993abc76dae221100989dfbbcc223aa7883909ad

Blockchain explained - Blockchain

Block	1	1	1	1
Nonce	78203	123034	23001	2341093
Data	1	1	1	1
Prev		000023098993abc76dae221100989dfbcc223aa7883909ad	000023098993abc76dae221100989dfbcc223aa7883909ad	000023098993abc76dae221100989dfbcc223aa7883909ad
Hash	000023098993abc76dae221100989dfbcc223aa7883909ad	000023098993abc76dae221100989dfbcc223aa7883909ad	000023098993abc76dae221100989dfbcc223aa7883909ad	000023098993abc76dae221100989dfbcc223aa7883909ad

Blockchain explained - Peer

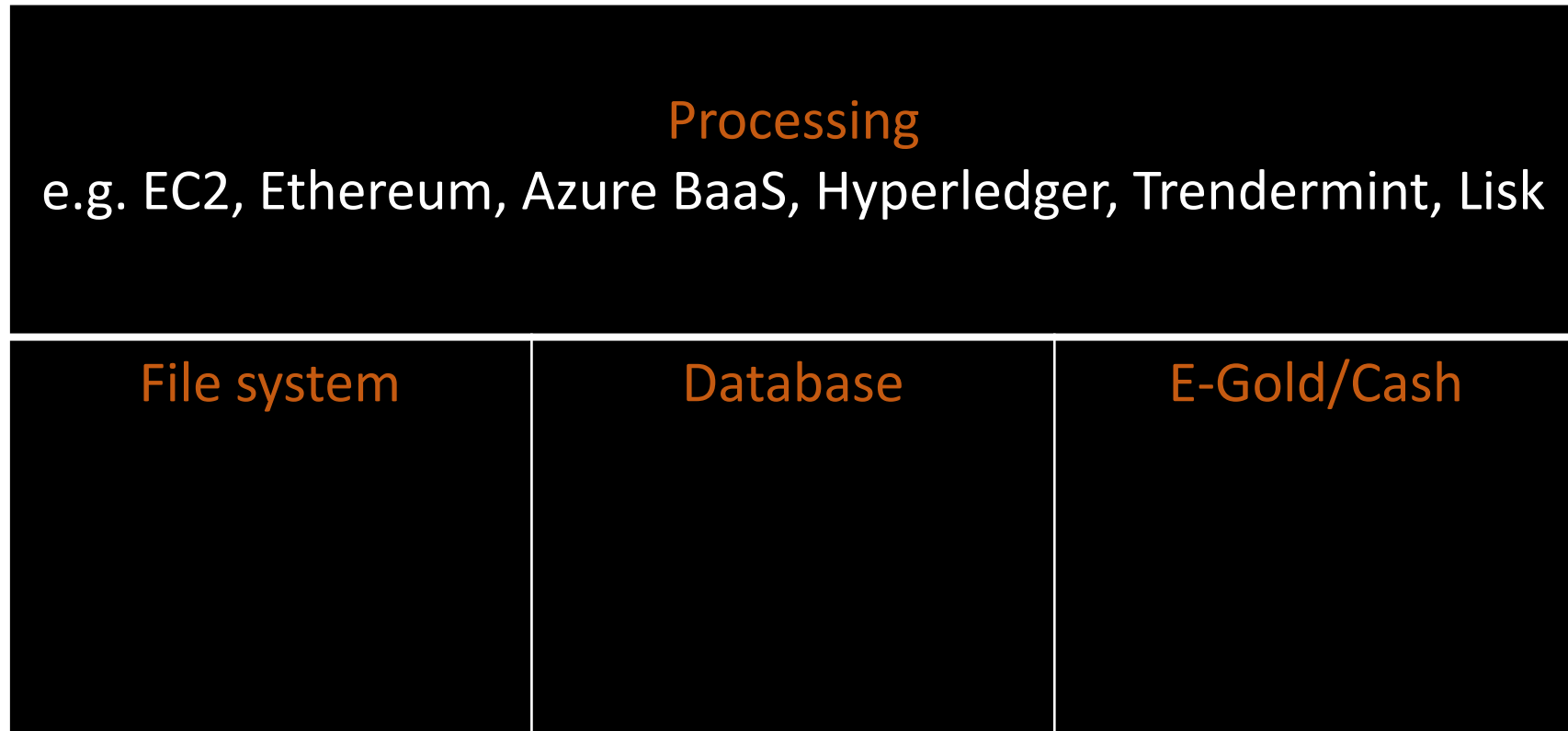


Adding meaning to a block – token and coinbase

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>

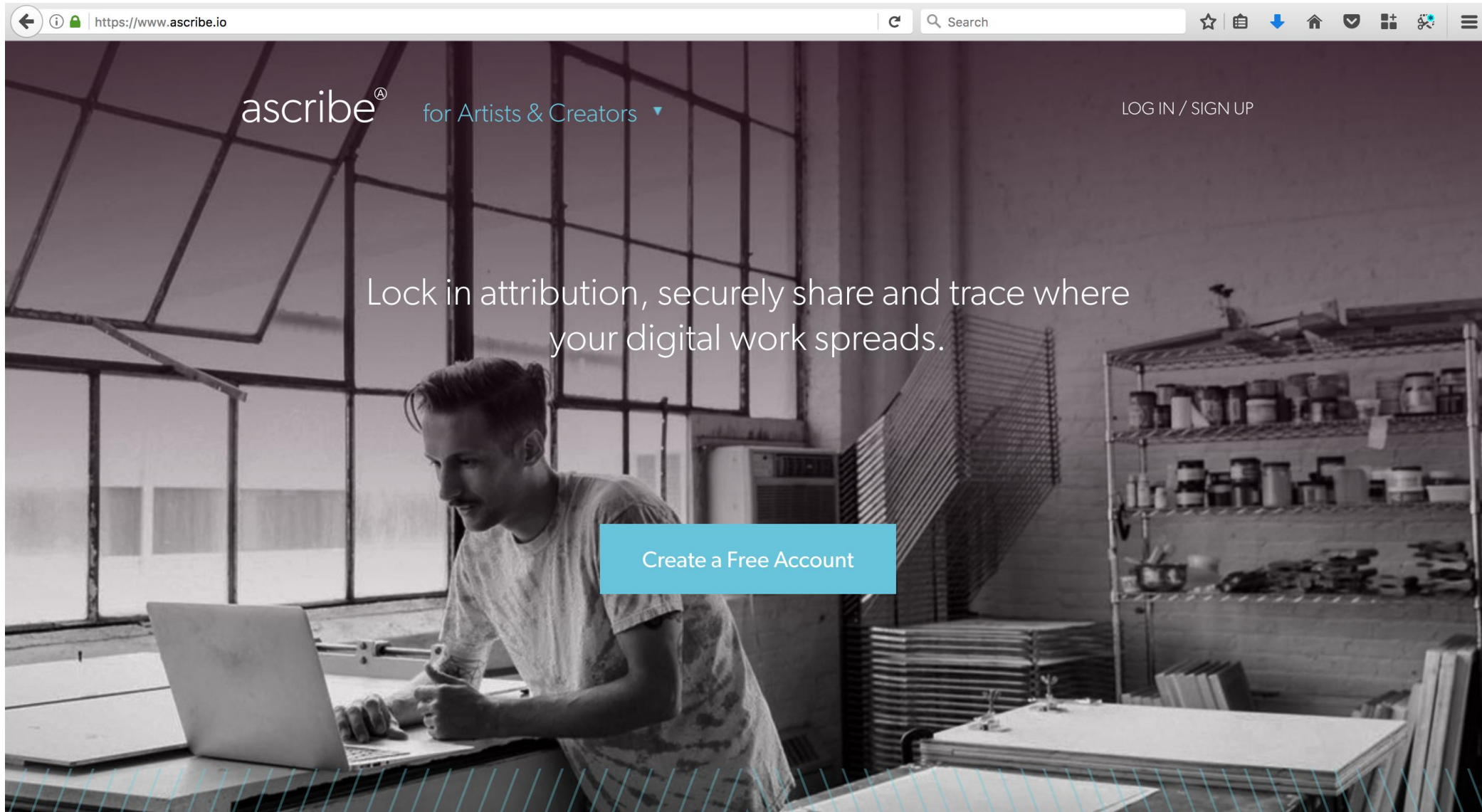
The emerging decentralized stack



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

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