Ethereum & ConsenSys, Public Ecosystem and Enterprise

Joseph Lubin

ConsenSys

Bitcoin – Where it All Began

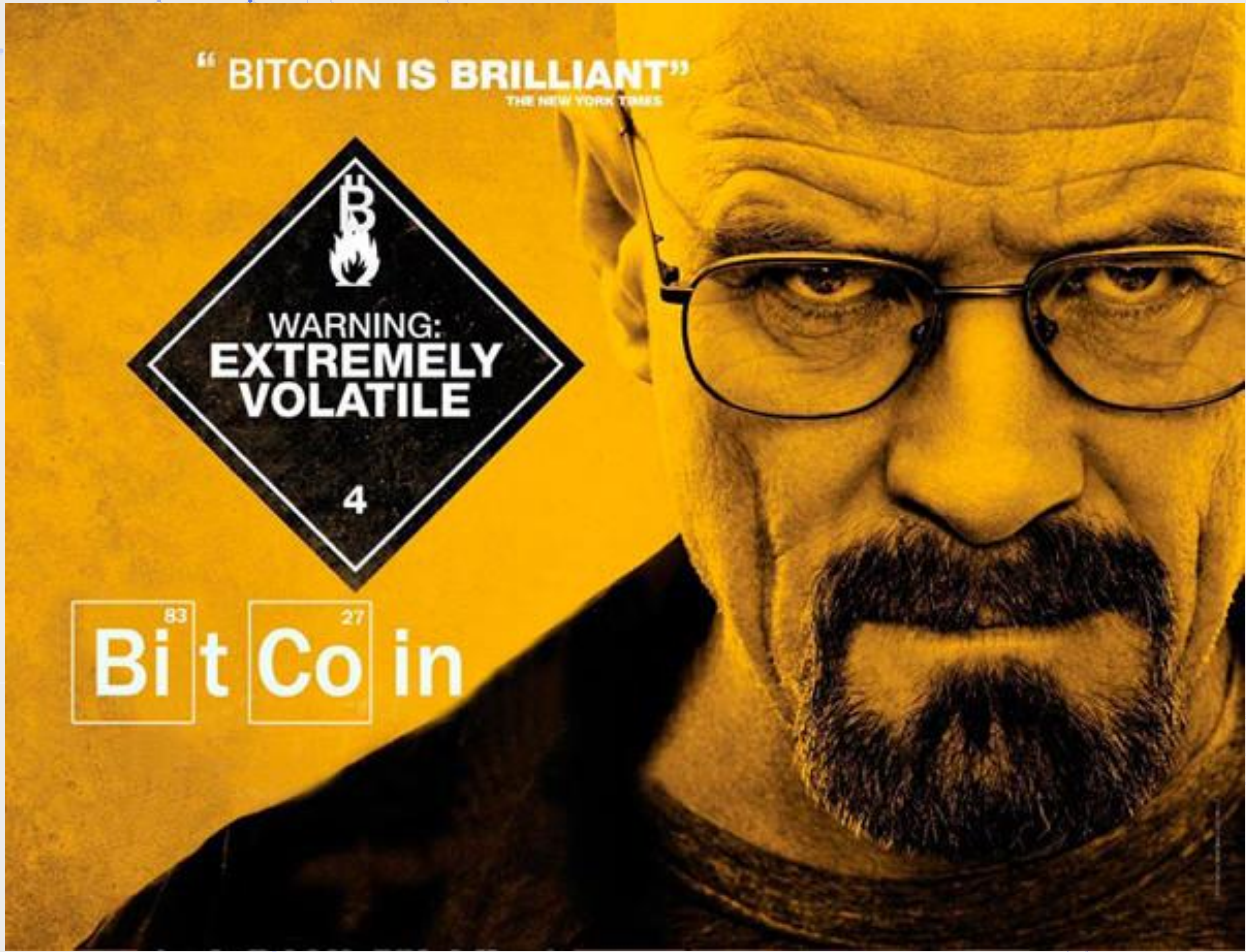
Bitcoin

November 2008 – a paper was posted on the Internet under the pseudonym **Satoshi Nakamoto** titled:

Bitcoin: A Peer-to-Peer Electronic Cash System

January 3, 2009 – the Bitcoin genesis block was created and **decentralized money** was born.

- Enabled a narrow set of use cases



Ethereum

From Genesis to Genesis

Bitcoin implemented the use case of decentralized money, but the implications were far more profound.

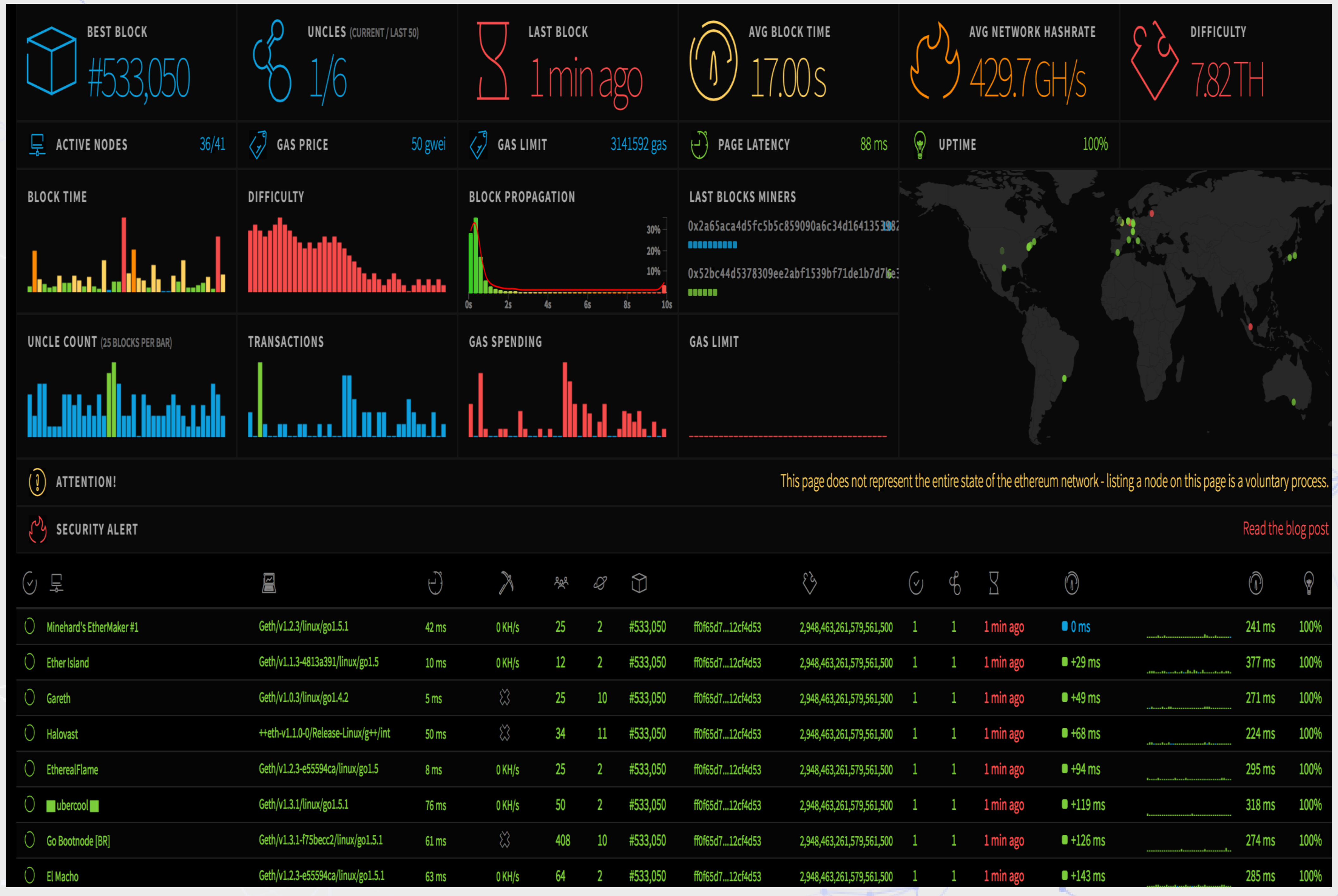
November 2013 – after working on various Bitcoin and Bitcoin 2.0 projects, Vitalik Buterin wrote Version 1 of the Ethereum White Paper.

January 25, 2014 -- Ethereum was publicly announced at the North American Bitcoin Conference in Miami.

From Genesis to Genesis

On July 30, 2015 the Ethereum 1.0 client was ready for launch and a tool was made available to construct the genesis block.

Many people around the world **constructed their own genesis blocks,** fired up the client they downloaded and watched in amazement as this tool which embodied a new organizing principle for humanity **organized itself into existence**.



BEST BLOCK #533,050
UNCLES (CURRENT / LAST 50) 1/6
LAST BLOCK 1 min ago
AVG BLOCK TIME 17.00s
AVG NETWORK HASHRATE 429.7 GH/s
DIFFICULTY 7.82 TH

ACTIVE NODES 36/41
GAS PRICE 50 gwei
GAS LIMIT 3141592 gas
PAGE LATENCY 88 ms
UPTIME 100%

LAST BLOCKS MINERS
0x2a65aca4d5fc5b5c859090a6c34d164135398z
0x52bc44d5378309ee2abf1539bf71de1b7d7be3

ATTENTION! This page does not represent the entire state of the ethereum network - listing a node on this page is a voluntary process.

SECURITY ALERT Read the blog post

○ Minehard's EtherMaker #1	Geth/v1.2.3/linux/go1.5.1	42 ms	0 KH/s	25	2	#533,050	ff0f65d7...12cf4d53	2,948,463,261,579,561,500	1	1	1 min ago	0 ms		241 ms	100%
○ Ether Island	Geth/v1.1.3-4813a391/linux/go1.5	10 ms	0 KH/s	12	2	#533,050	ff0f65d7...12cf4d53	2,948,463,261,579,561,500	1	1	1 min ago	+29 ms		377 ms	100%
○ Gareth	Geth/v1.0.3/linux/go1.4.2	5 ms	✗	25	10	#533,050	ff0f65d7...12cf4d53	2,948,463,261,579,561,500	1	1	1 min ago	+49 ms		271 ms	100%
○ Halovast	++eth-v1.1.0-0/Release-Linux/g++/int	50 ms	✗	34	11	#533,050	ff0f65d7...12cf4d53	2,948,463,261,579,561,500	1	1	1 min ago	+68 ms		224 ms	100%
○ EtherealFlame	Geth/v1.2.3-e55594ca/linux/go1.5	8 ms	0 KH/s	25	2	#533,050	ff0f65d7...12cf4d53	2,948,463,261,579,561,500	1	1	1 min ago	+94 ms		295 ms	100%
○ 🟩ubercool🟩	Geth/v1.3.1/linux/go1.5.1	76 ms	0 KH/s	50	2	#533,050	ff0f65d7...12cf4d53	2,948,463,261,579,561,500	1	1	1 min ago	+119 ms		318 ms	100%
○ Go Bootnode [BR]	Geth/v1.3.1-f75becc2/linux/go1.5.1	61 ms	✗	408	10	#533,050	ff0f65d7...12cf4d53	2,948,463,261,579,561,500	1	1	1 min ago	+126 ms		274 ms	100%
○ El Macho	Geth/v1.2.3-e55594ca/linux/go1.5.1	63 ms	0 KH/s	64	2	#533,050	ff0f65d7...12cf4d53	2,948,463,261,579,561,500	1	1	1 min ago	+143 ms		285 ms	100%

Eighteen Months Later…

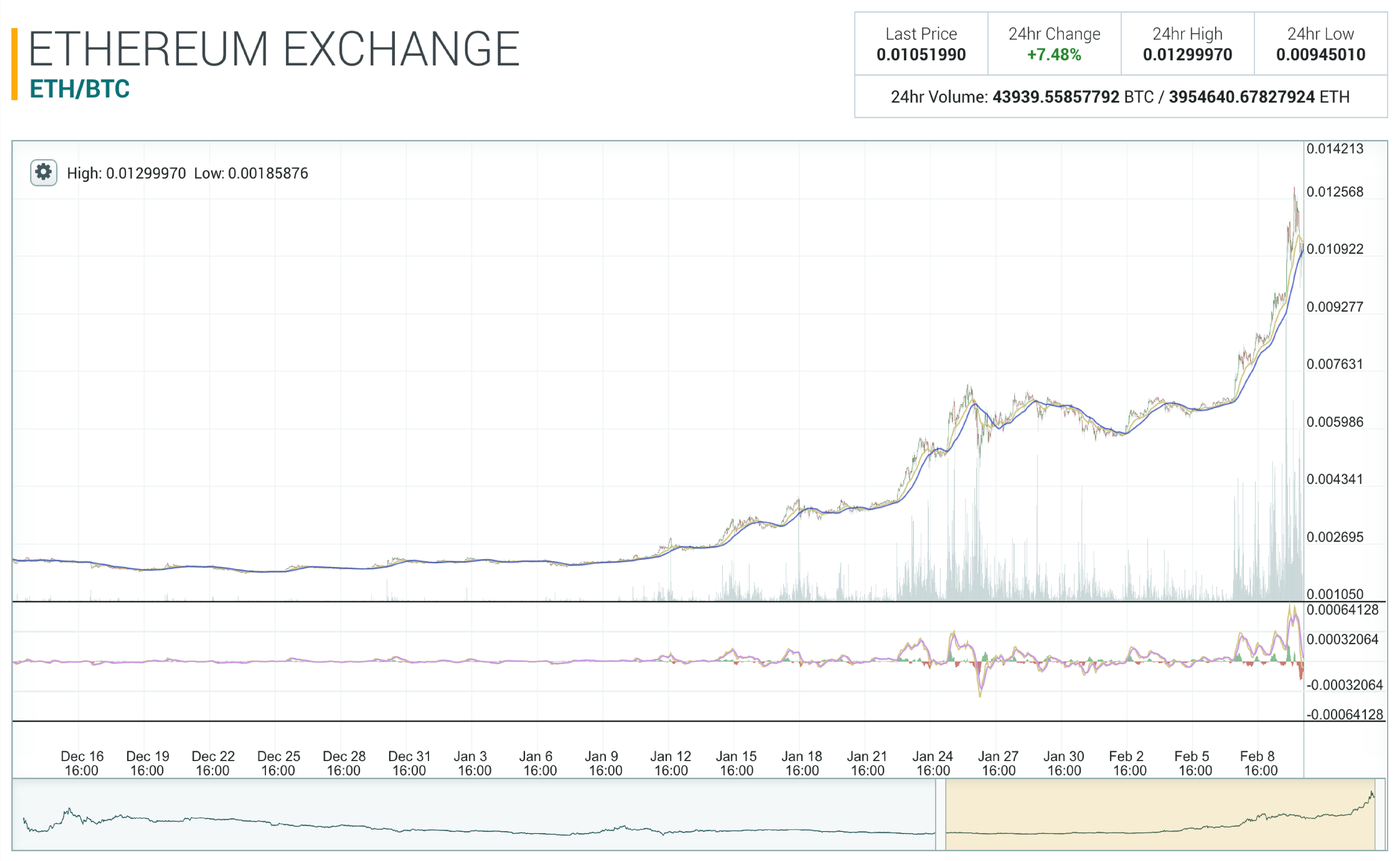
Price:

- ~ $10 USD
- (up from $0.20

at genesis sale)

Monetary base:

- ~ $1,000,000,000



ETHEREUM EXCHANGE

ETH/BTC

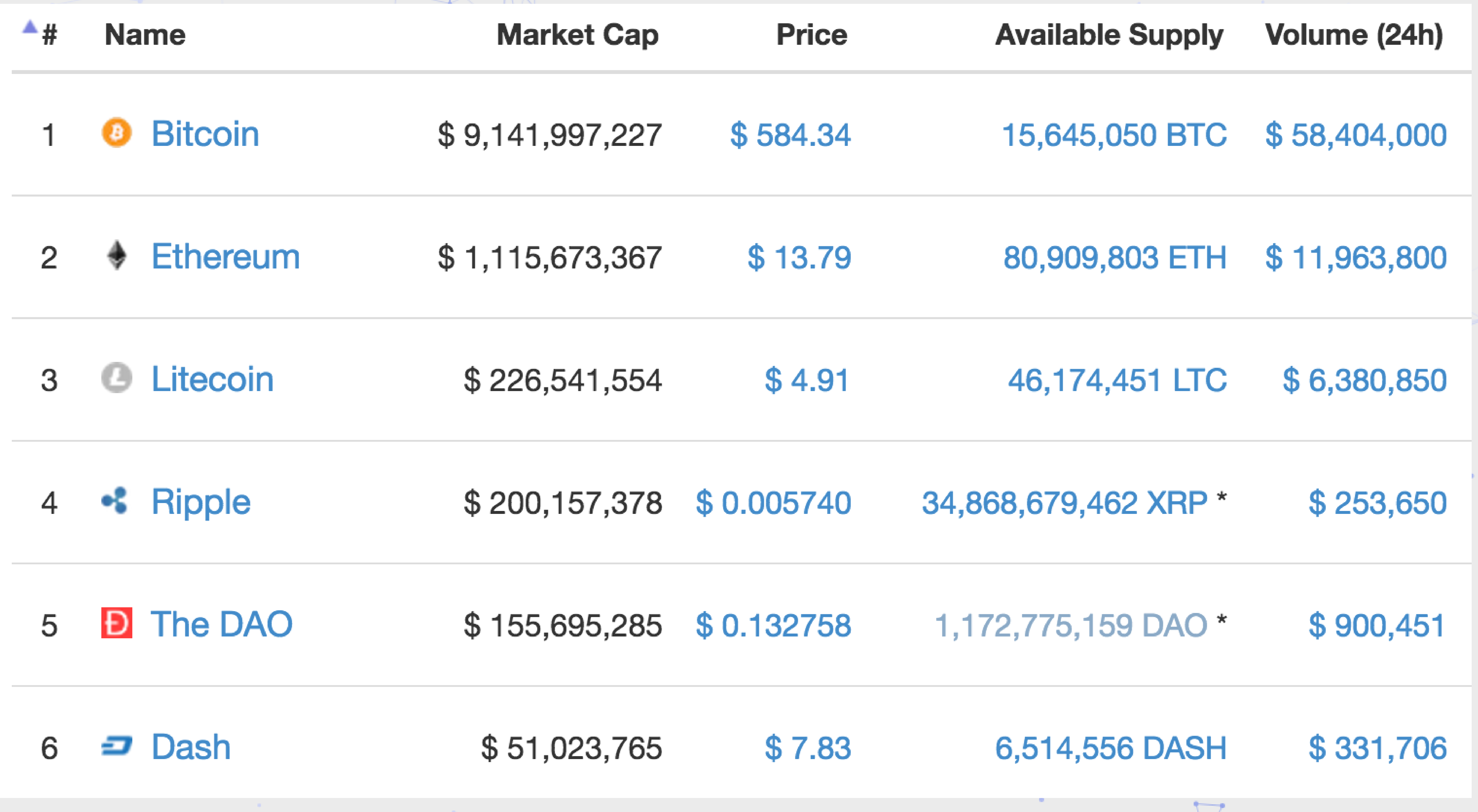
Last Price	24hr Change	24hr High	24hr Low
0.01051990	+7.48%	0.01299970	0.00945010

24hr Volume: 43939.55857792 BTC / 3954640.67827924 ETH

High: 0.01299970 Low: 0.00185876

Eighteen Months Later…

#2 in size of monetary base and transaction volume behind Bitcoin.



#	Name	Market Cap	Price	Available Supply	Volume (24h)
1	Bitcoin	$ 9,141,997,227	$ 584.34	15,645,050 BTC	$ 58,404,000
2	Ethereum	$ 1,115,673,367	$ 13.79	80,909,803 ETH	$ 11,963,800
3	Litecoin	$ 226,541,554	$ 4.91	46,174,451 LTC	$ 6,380,850
4	Ripple	$ 200,157,378	$ 0.005740	34,868,679,462 XRP *	$ 253,650
5	The DAO	$ 155,695,285	$ 0.132758	1,172,775,159 DAO *	$ 900,451
6	Dash	$ 51,023,765	$ 7.83	6,514,556 DASH	$ 331,706

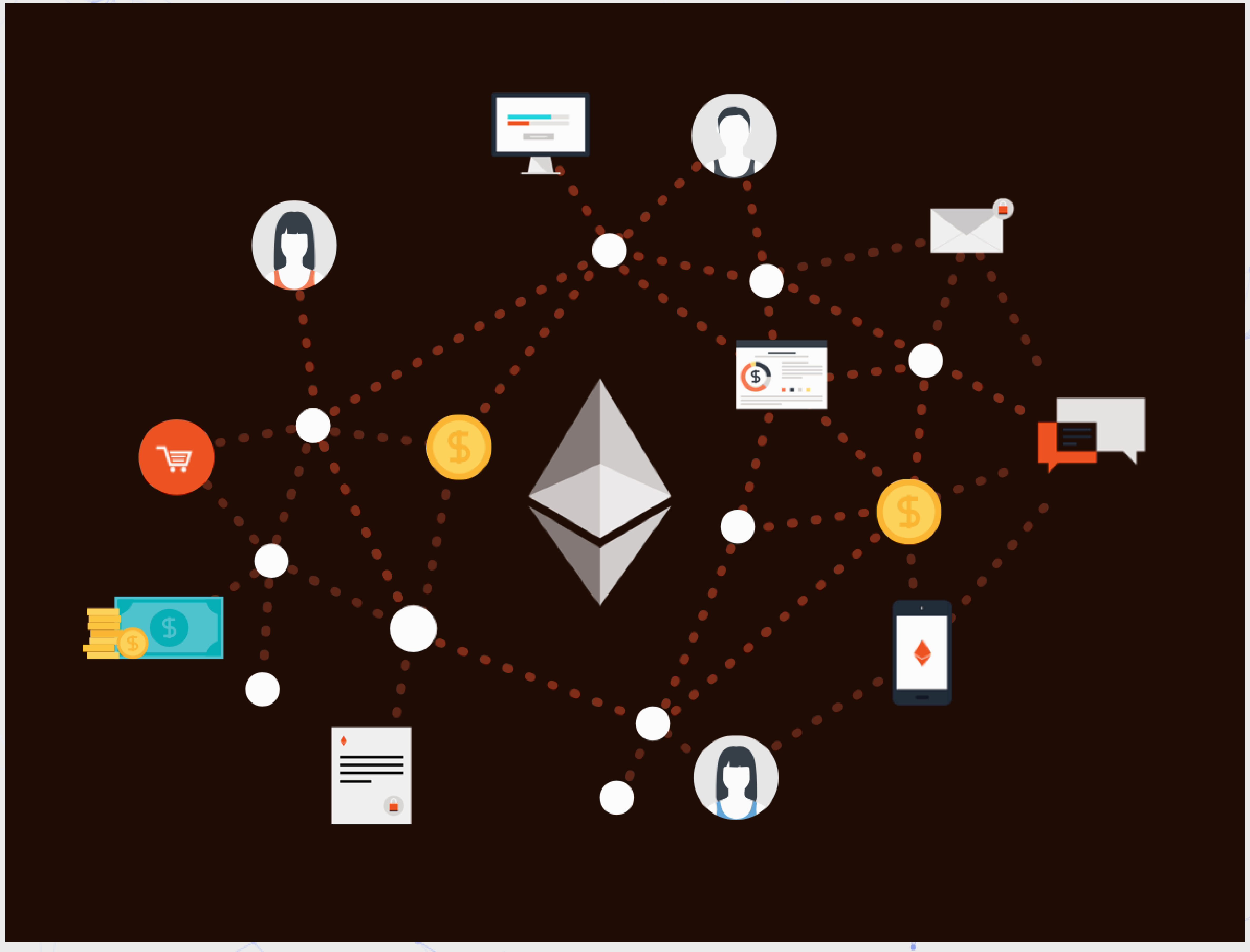
From Genesis to Genesis

The Ethereum team set out to build:

A platform for decentralized applications

As a software platform, we intended from the start to be agile, to move fast and continually upgrade.

Software platforms that don’t continuously improve soon become irrelevant.

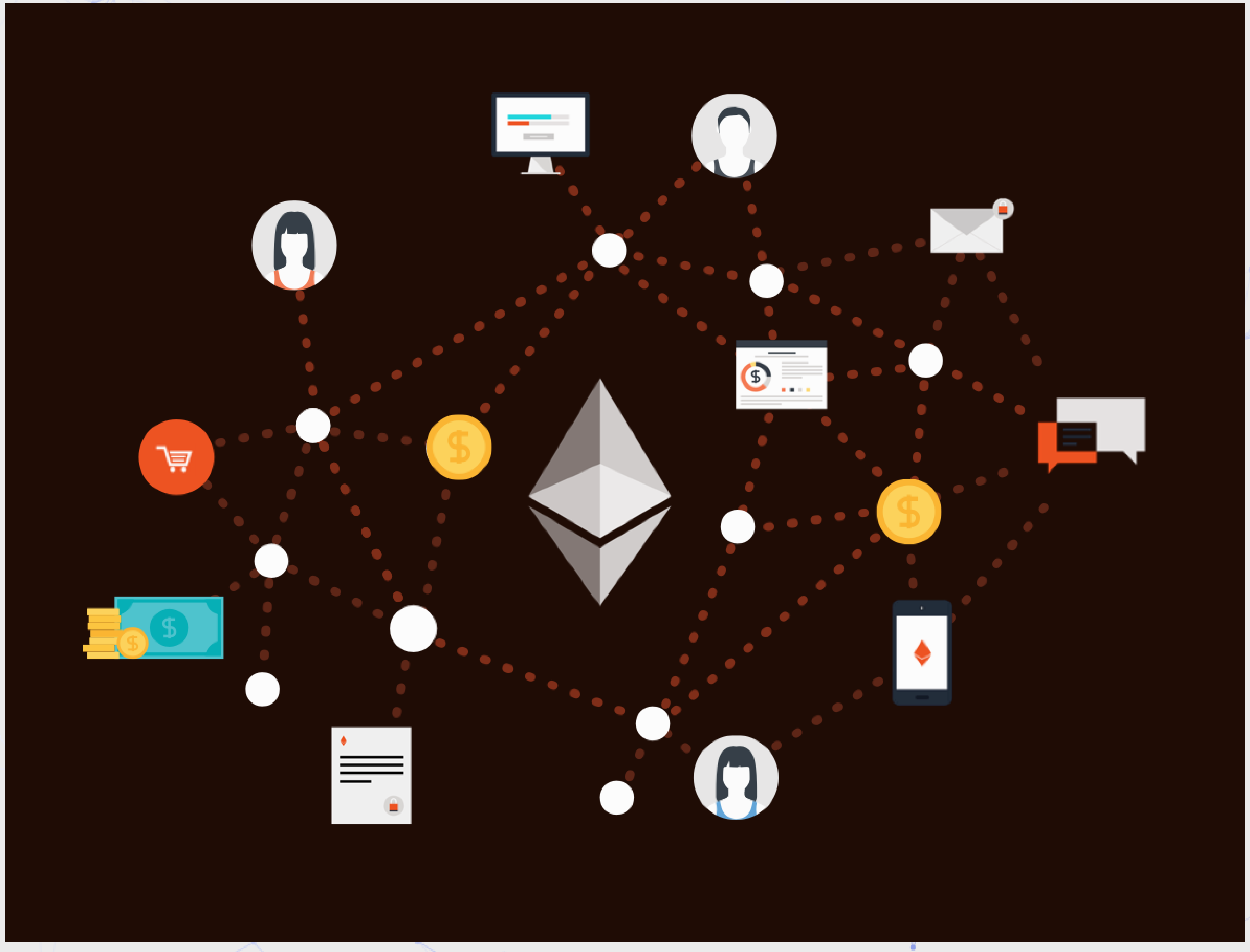


From Global Currency to World Computer

The Ethereum Project has built:

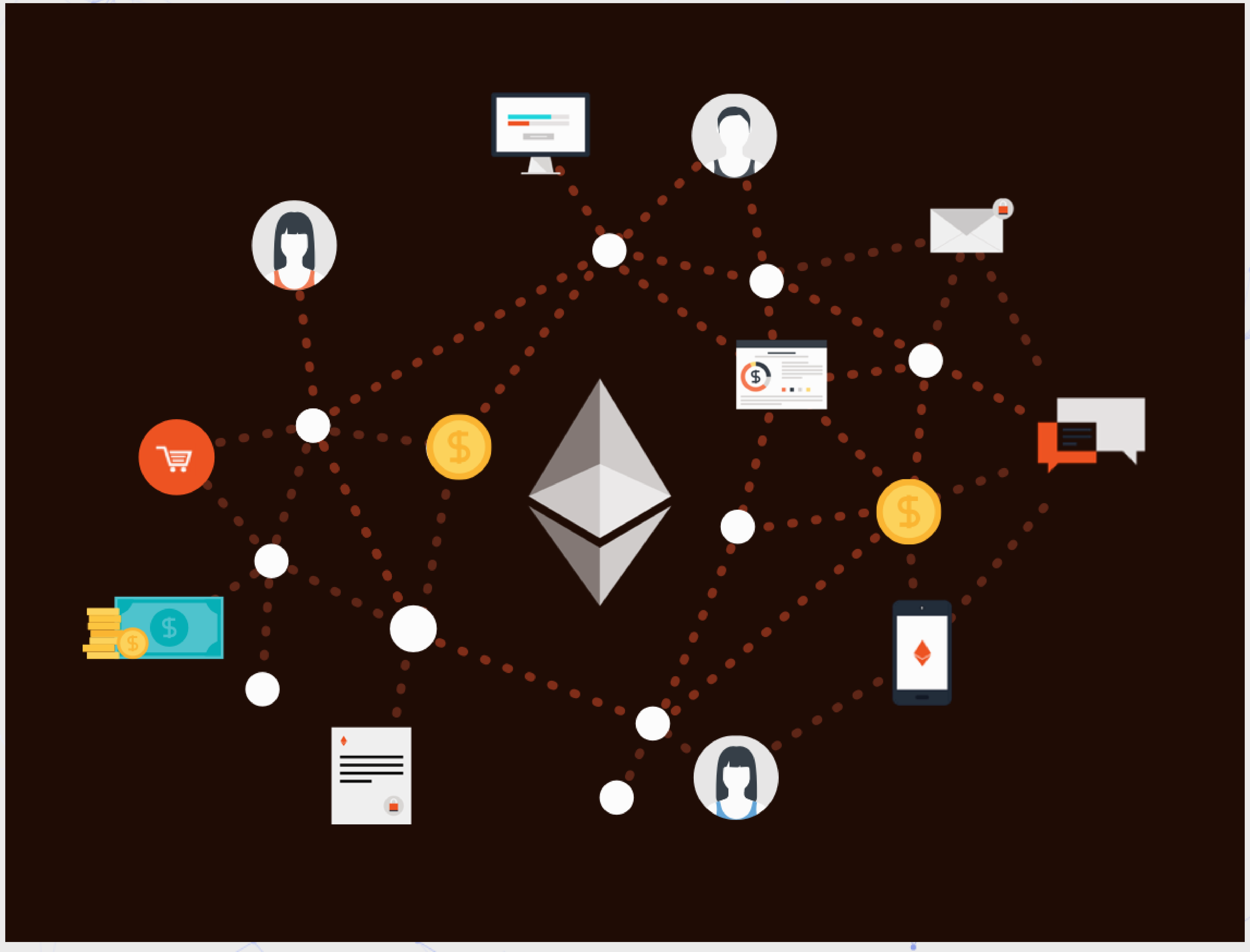
- the most powerful, most capable blockchain platform
    - public, permissionless
        - (the hard problem)
    - private, permissioned

The public network is the **first general purpose World Computer**.



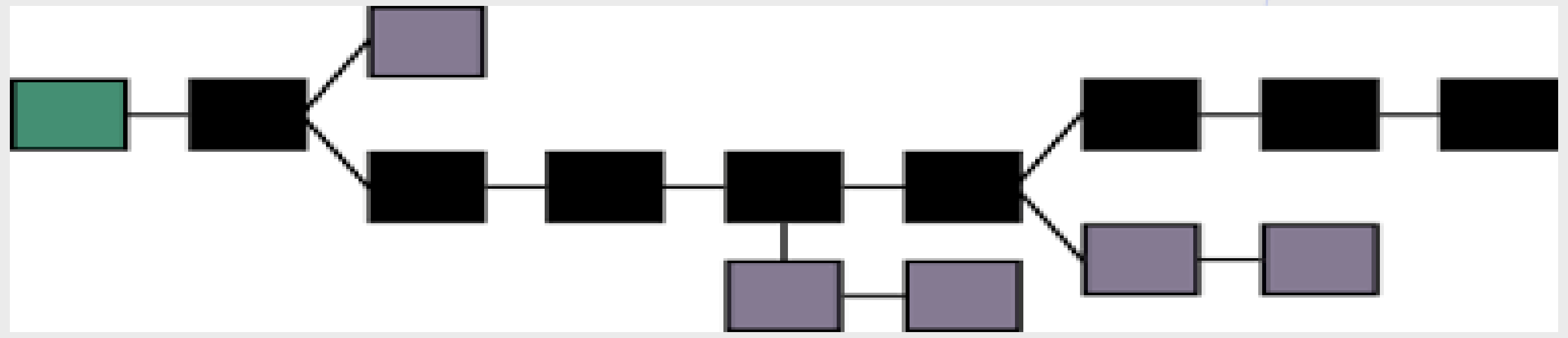
From Global Currency to World Computer

The Ethereum World Computer's dynamics and capabilities arise from a synergy of 5 interacting technological elements that are common between the Bitcoin and Ethereum Protocols.



Element 1: The Blockchain Database

A next-generation database structure called the blockchain.



- A block is a set of transactions that have been validated by peers on the network.
- The blockchain is chain of blocks linked to one another, constituting a time-stamped, shared, non-repudiable database that contains the entire logged history of the system.
- Each transaction processor on the system maintains their own local copy of this database and consensus formation algorithms enable every copy to stay in sync.

Element 2: A Cryptographic Token

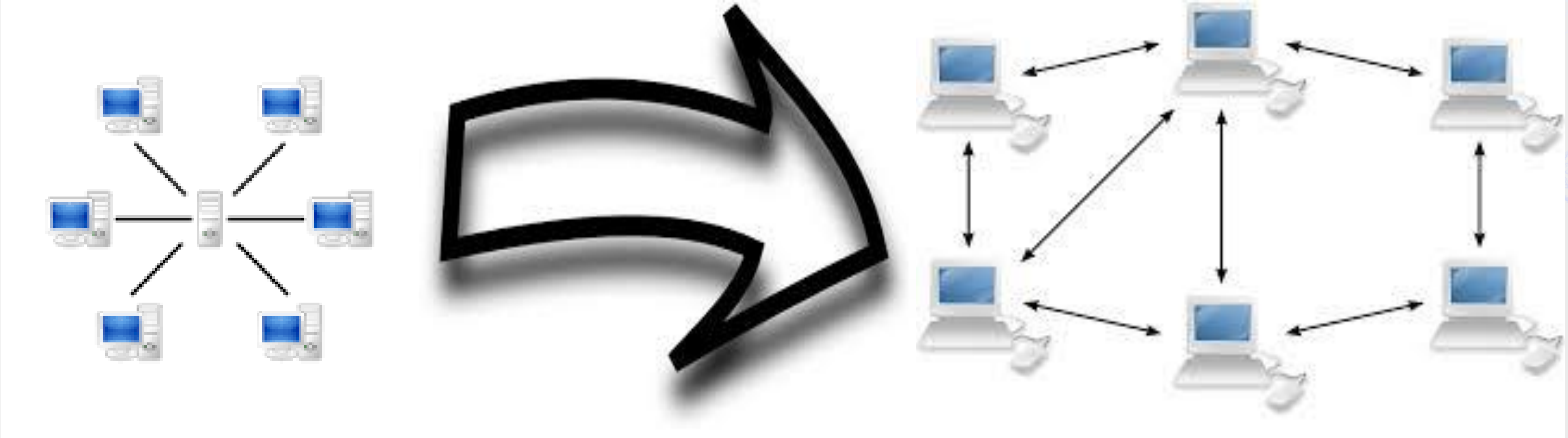
A cryptographic token, the bitcoin (BTC) in the Bitcoin protocol, and ether (ETH) for Ethereum.

- BTC serves as the cryptographically secured **unit of value, numeraire and currency** in the case of the Bitcoin protocol.
- ETH serves as the cryptographically secured **unit of value, numeraire and hybrid fuel/currency** for the Ethereum protocol.
  - **Tiny amounts of this fuel are required to pay for computational steps and storage operations on the platform.**

Element 3: Peer-to-peer Network

A peer-to-peer network for peer discovery and data transmission.

- **This turns the traditional client-server architecture of the web into the peer-to-peer architecture of the new decentralized web in which every node is both client and server.**
- **This diffuses information silos and removes single points of control or vulnerability.**



Element 4: Consensus Formation Algorithm

In Bitcoin, all transaction processors (miners) come to consensus about **what happened and when with respect to transmission and storage** of the bitcoin value token.

- **This happens approximately every 10 minutes.**
- **This requires a slim majority of honest processors**

Element 4: Consensus Formation Algorithm

In Ethereum, all transaction processors (miners) come to consensus about **what happened and when with respect to transmission and storage** of the ether value token as well as coming to an agreement **about all of the processing** that is done in **all of the shared programs** on the Ethereum World Computer.

- **This happens approximately every 15 seconds.**
- **This requires a slim majority of honest processors.**

Element 5: Virtual Machine & Prog Lang

The Bitcoin virtual machine enables narrowly programmable money.

- It is like a pocket calculator at each node of the network.
- Data is decentralized; program operating on that data are not.

The Ethereum virtual machine and powerful high-level programming language enables fully decentralized applications.

- It is like a general purpose computer at each node of the network.
- Data and their programs are decentralized.

Element 5: Virtual Machine & Prog Lang

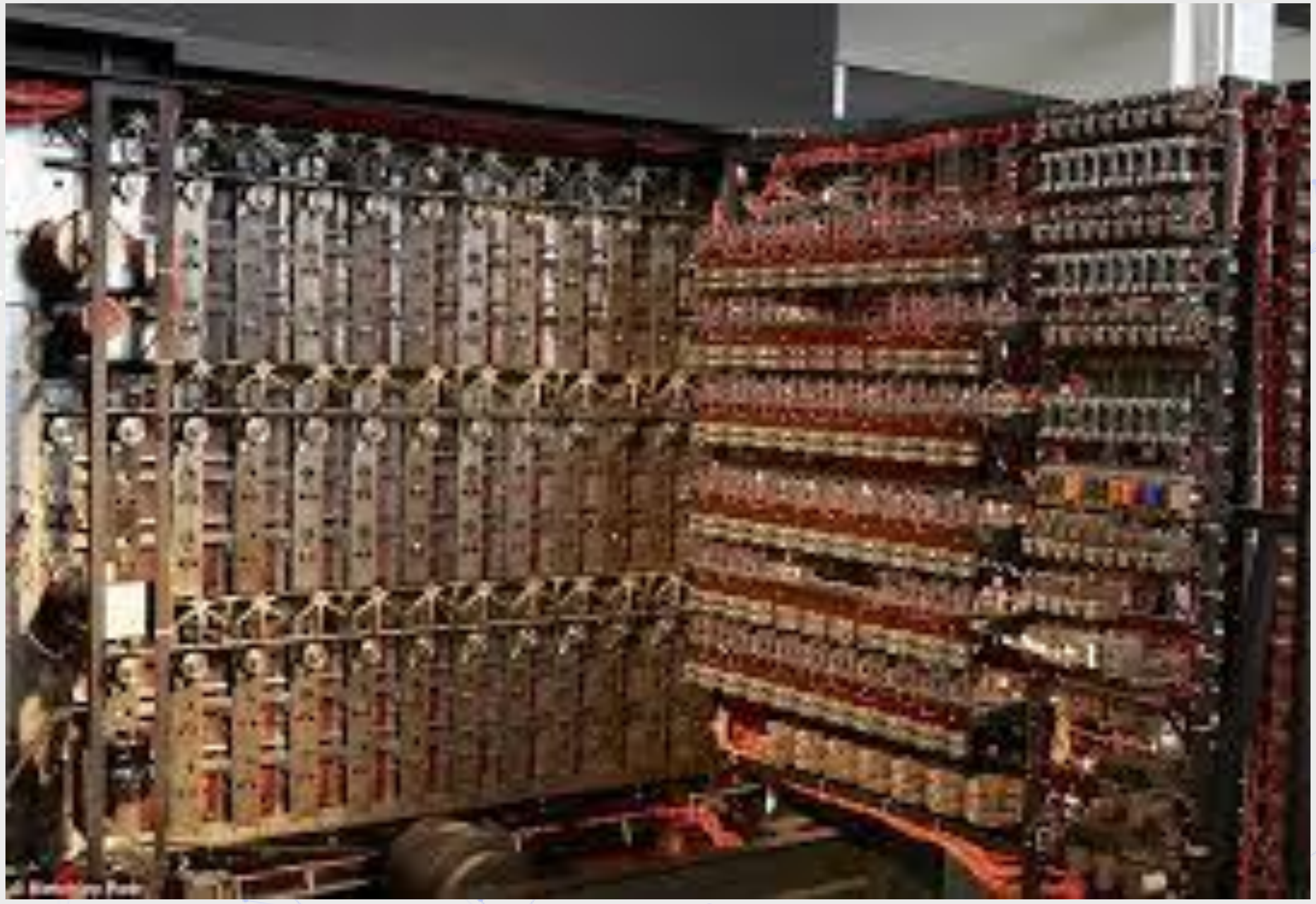
Partially decentralized apps on Bitcoin may be built by specialist programmers who have expertise in cryptography.

- **Data storage requires stuffing optimized data into a few bytes in transactions; this is 1970’s style development.**
- **Most programmatic capability must be achieved outside of the narrow protocol.**
- **If security is required, cryptographic primitives must be configured by specialist programmers.**
- **Building functionality on top of Bitcoin is probably a couple orders of magnitude slower and more difficult than in Ethereum.**

Ethereum’s Core Value Proposition for Developers

Arbitrarily complex decentralized apps in Ethereum can be built by non-specialist programmers entirely within the full security of the protocol.

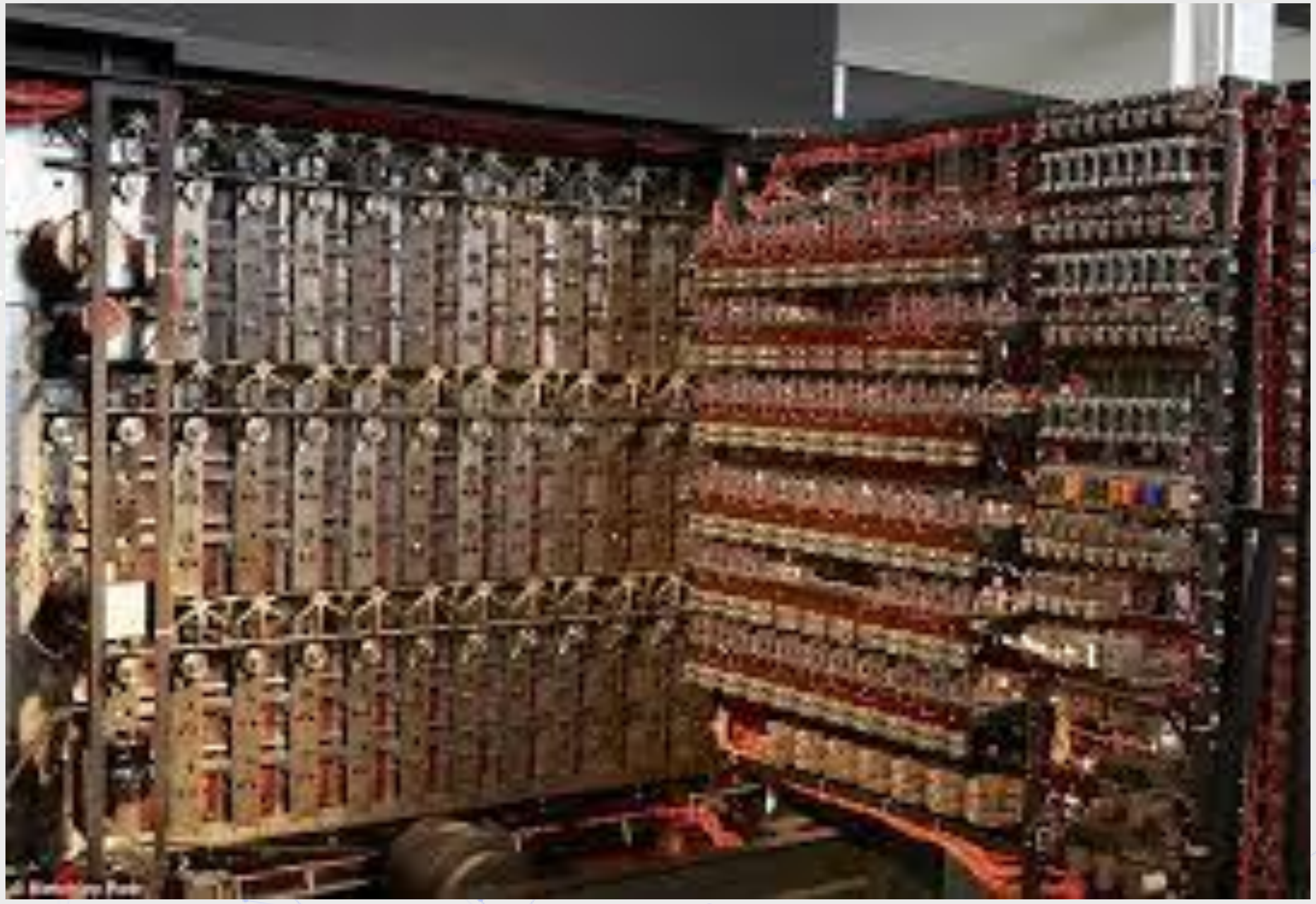
- contrast with developing on Bitcoin-like codebases



Ethereum’s Core Value Proposition for Developers

Clean separation of protocol from app layer

- App level programming is made familiar to millions of devs
- Rich dev community
- Rich dev tools



Why is Public Blockchain Important for Those Interested in Private Blockchain Use Cases

- Many more developers than for proprietary platform
  - two orders of magnitude more than Hyperledger/Chain/R3?
- Public value token incentivizes many startups
- Crowd funding mechanisms enable start-ups to form
- Codebase is scrutinized by thousands of devs and hackers
  - much more secure than typical banking software
- Every company will eventually want to use public blockchain

Developers, Developers, Developers

- 30,000 downloads of Truffle and TestRPC, our developer’s tooling
- 40,000,000 Infura service requests per day on average
- 20,000+ developers currently in the ecosystem

TRUFFLE

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What is a Decentralized Application (dApp) on Ethereum?

A dApp is a set of smart contracts serving as a shared database back end, with code built into the smart contracts that operates on the data stored in those smart contracts.

Some sort of user interface serves as the front end to these smart contracts.

dApps are deployed into a blockchain, by loading the executable code into a transaction and injecting it into the network.

What is a Decentralized Application (dApp) on Ethereum?

Note that the complete state of the blockchain includes

- object data/state + behavior/functions
- consensus operates on this entire state

Makes it harder to cheat on the business logic of an application

- a change in business logic (e.g. complex pricing model) is more easily detected if code is on chain

Better foundation on which to build systems

The Ethereum World Computer or private systems built on Ethereum serve as a **configurably transparent, non-repudiable, shared source of truth** for any kind of business process.

Better foundation on which to build systems

The **Ethereum World Computer** is a substrate for building global economic, social and political systems that can be:

- Deeply secure
- Non-repudiable
- Uncensorable (public version)
- Natively interoperable
- Transparently auditable yet configurably private in certain circumstances.

Simplest view: Next generation database

Next generation database architecture and DBMS

- 60 years of database models and management systems
  - flat file, hierarchical, relational, object, No SQL or non-relational
  - non-relational was required by entities like Facebook, Netflix, Twitter, Amazon, google, ...
    - built systems so large that they had to shard their databases (split into pieces)
    - replication became very important to keep the shards somewhat up-to-date

- Blockchain makes replication a first class citizen and consensus mechanisms enabling this breakthrough are responsible for ushering in a new era of computing:
  - **Veridical (of or pertaining to the truth) or Trust Minimized computing**

- Societal structure partly determined by information storage and processing technologies of the era

Veridical, Trust Minimized Computing

When every stakeholder on a blockchain-based peer-to-peer network has their own copy of the data and their own copy of the rules (smart contracts) by which the state of the data may be affected:

- **For public or private blockchain systems, everyone can feel assured that there is no opportunity for improper manipulation of the system by:**
  - Rogue system administrators
  - Corrupt CFOs
  - Hackers

Next Generation in Secure IT Infrastruct

Every interaction with all business processes will be **strongly cryptographically authenticated with granular authorization based on roles and privileges.**

No more traditional vulnerable IT security architectures: firewall-fenced soft targets.

Security issues move to periphery: protection of private keys

Broad Implication: Force for Universal Disintermediation

More Secure IT Infrastructure (everything is a crypto xaction) +
Veridical Computing (trustworthiness) +
peer-to-peer network ➔

Universal
Disintermediation

Broad Implication: Force for Universal Disintermediation

Universal Disintermediation ==>

This will disrupt every industry

(though early acting incumbents will likely adapt)

Blockchain & Ethereum: Challenges and Roadmap

Challenges and Roadmap:

Scalability – A Roadmap

Scalability: Ethereum Version 1.0 → 2.0

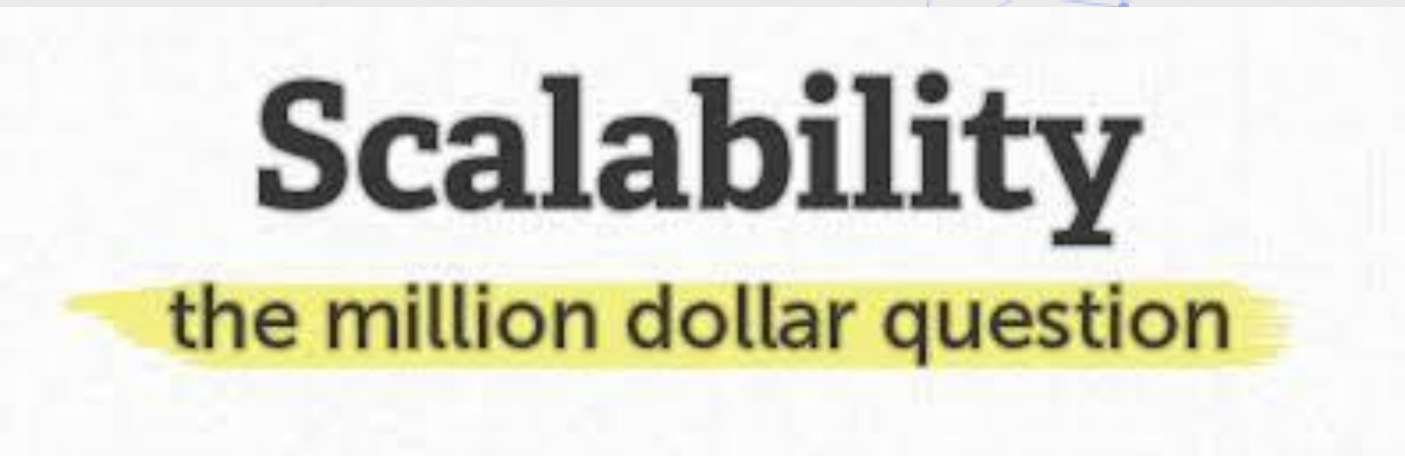
Ethereum Version 1.0 is largely **feature complete**,

released and running beautifully.

It was important to get it out into the world ASAP so that devs (like you) can **start figuring out how to effectively build decentralized applications** and how to build businesses or decentralized businesses in this space.

The **roadmap** and technologies that will enable the first truly scalable version of Ethereum -- version 1.5 and beyond -- have been under development for a year already and are looking promising.

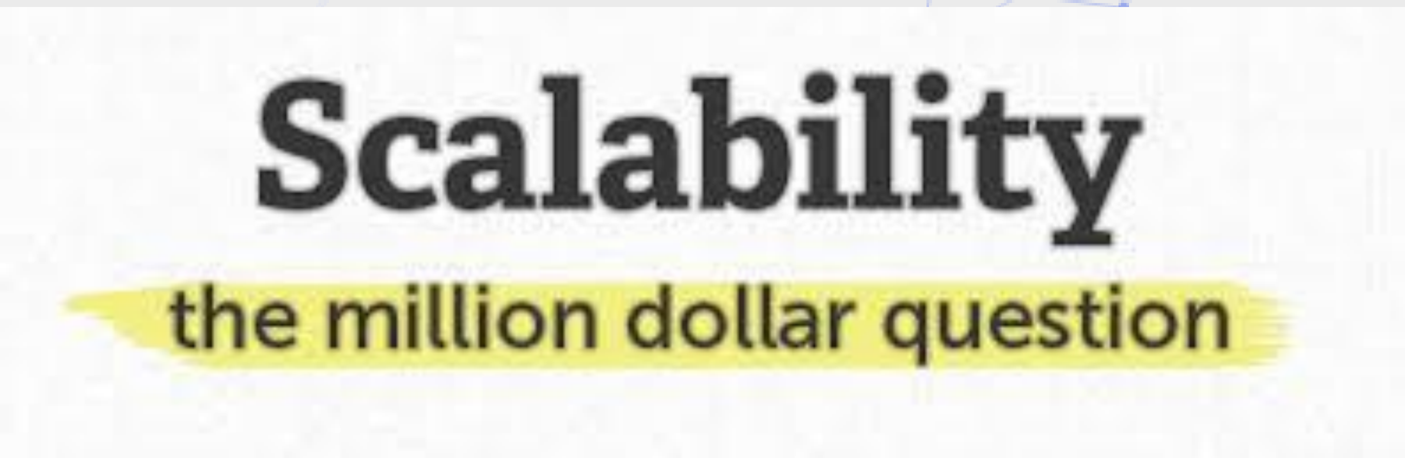
- These include moving to a **Proof of Stake** consensus algorithm and **Sharding.**
- **Scalability is probably the winner-take-all holy grail.**



Scalability: Off-blockchain Solutions

State Channels

- simple 2-party channels
- n-party network channels
- state channels applications
    - payments (micropayments)
    - gaming
    - decentralized exchanges
    - everything ….



Scalability

the million dollar question

Challenges and Roadmap:

Privacy – A Roadmap

Privacy Options and Roadmap

- Now
  - Encrypted data on public or private blockchains
  - **Off-chain solutions: State Channels**
  - Private Enterprise Blockchain Systems
  - Private Consortium Blockchain Systems
  - Hub and Counterparty Blockchain Systems

- Next few years
  - Partially Homomorphic Encryption
    - ZCash on Ethereum is just starting to happen
    - 10^6 times slower than plaintext processing
  - Fully Homomorphic Encryption
    - 5-10 years?
    - 10^12 times slower than plaintext processing

Privacy and Scalability Roadmap

Architectures for configurable Privacy/Confidentiality and Scalability will be substantially solved within two years.

And scalability will continue to improve over time to the point that adding a new compute resource to the network will increase the transactional throughput linearly with each new device added.

Public vs. Private Blockchain

Public vs. Private Blockchain

Though not yet scalable, Ethereum has solved the hard problem of consensus formation in the public context

- It is easy to relax constraints in situations with stronger governance and optimize various dimensions like tps throughput
- It is probably impossible to start with a proprietary private permissioned architecture and grow it into a public, permissionless blockchain architecture

Public vs. Private Blockchain

Since Ethereum is arguably more flexible and powerful than all other blockchain application platforms for private, permissioned systems, and

Since companies will likely eventually want to deploy some use cases on public blockchain,

It doesn’t make sense to build/buy blockchain stacks that are not Ethereum (at least EVM) compatible, because

- **You will eventually have to build/buy a parallel stack for your public Ethereum applications**

What is ConsenSys?

History of ConsenSys: dApps

Formed 27 months ago.

Initial Mission: To build products and services for the Ethereum Ecosystem.

Develop MVPs and seek external funding for most of them.
Currently have two companies in our portfolio.

CONSENSYS

History of ConsenSys: Deep Infrastructure

- **Because we formed 10 months before Ethereum 1.0 was released, we had to build lots of deep infrastructure.**
  - BlockApps’ EthereumH: Haskell Ethereum Client
  - EtherCamp’s EthereumJ: Haskell Ethereum Client
  - EtherCamp’s blockchain explorer
  - Truffle, TestRPC
  - MS Visual Studio Solidity Project Template
  - Infura

BlockApps

TRUFFLE

History of ConsenSys: Enterprise

- **18 months ago: ConsenSys Enterprise Was Formed**

- **Mission:**
  - Help enterprises formulate their blockchain strategy
  - Build custom blockchain-based software solutions for enterprise
  - Currently building solutions in:
    - Financial Services Industry
      - Securities, Tokenized Currency, Insurance, Precious Metals Warehousing
    - Energy Industry
    - AdTech Industry
    - Healthcare Industry
    - Gaming Industry
    - Supply Chain Management and Provenance Tracking

consensys
ENTERPRISE

Core Components / Building Blocks

- **Identity / Persona (uPort)**
- **Wallet (uPort Wallet)**
- **Multifaceted and multi-layered Reputation System (RepSys / uPort)**
- **Registries System**
  - ConsenSys's Regis
  - Ethereum Foundation NameReg
  - Nexus's Ethereum Name System

Core Components / Building Blocks

- **Token Factory**
  - Token Issuance & Management
- **EtherEx Token Exchange System (Native and Subtoken)**
- **Price-stable Token Systems (USD, JPY, EUR, Gold, …)**
- **Voting Systems (Boardroom, Parametrized, Liquid Democracy)**

Core Components / Building Blocks

- **Glue Systems for linking blockchains**
  - Joseph Chow's BTC Relay

- **Cron Systems**
  - Piper Merriam's Ether-Alarm

- **Computation Markets**
  - Piper Merriam's ethereum-computation-market

Core Components / Building Blocks

- **State Channels / Off-chain Transaction Adjustment Channels**
  - Micropayments
- **dApp Store**
- **Libraries (math, ...)**
- **MetaMask EtherBrowser**

Standalone dApps

- **Balanc3** -- Triple Entry Accounting System
- **eSign** -- Smart Document Creation and Management System
- **Noncense** -- Decentralized Reddit
- **BoardRoom** -- Org Governance System
- **WeiFund** -- (Equity) Crowdfunding System

BALANCE

BoardRoom

ΞSign

Open (Industry) Platforms

- **Gnosis Prediction Markets Platform**
- **ujo Music/Film/Art Industry Platform**
  - and other modalities on the way: images, words, code, ...
- **Inflekt -- Event and Community Management System**
- **EtherPoker**
- **EtherLoan**
- **SafeMarket** (OpenBazaar / Amazon-like market)
- **Benefactory** (communities crowdfund grant proposals)

Benefactory

GNOSIS

ujo MUSIC

safemarket

P2P TRADE SYSTEM

INFLEKT

Some Implications (A Roadmap)

Implications for People

Next Generation Identity & Reputation

Blockchain is first global, long-term persistent shared database

uPort: Self-sovereign Identity

Persistent portable reputation

Enfranchise the entire world's population in the emerging decentralized global economy

Foundations: Decentralized energy (electricity) industry infrastructure

Very soon we will go into a pilot where Alice on one side of the street will be able to get paid for selling electrons to Bob on the other side of the street.

- **Alice’s systems will be able to flip from prosumer selling mode to consumer buying mode based on the level of her battery**

Foundations: Open financial industry infrastructure

Foundationally, people should be able to have control of their own identity elements and valuable assets

Avail self of financial services offered in different jurisdictions

- Establish financial relationship

We are building KYC on top of identity and reputation, which will enable:

- Next Gen Financial Industry Infrastructure

Implications for Companies

Do Private Enterprise Blockchains Make Sense?

An enterprise can be viewed as a set of cooperating and competing internal groups.

All feed from the same budget.

In microcosm, this is a complex society, that can benefit from **a shared source of truth** for its business processes.

Next Generation in IT Architecture

The future of IT will be **many private enterprise blockchains, many private consortium blockchains** and **some public blockchains** and other decentralized resources (e.g. storage, bandwidth, compute).

- Business processes embodied as **state transition graphs** in smart contracts.
- Business processes will be splayed across these chains, based on use case.
- Access to these business processes will be from an identity portal that each actor controls with their private keys.
  - Employees
  - Customers
  - Vendors / Service providers

Foreshadowing the Enterprise Ethereum Alliance

A group of 30+ large and small companies from many industries

- Nearly all are actively using private, permissioned Ethereum
- Eliminate duplicative effort
- Support each other

Ethereum is winning the grass roots mindshare battle for developers.

Enterprise Ethereum Alliance will solidify mindshare in the Enterprise space.

Multiple tracks of activity:

- Main stream, “holy grail” track will build modular Ethereum 2.0
- Configure one way for public blockchain
- Configure differently for different private, permissioned architectures

Official launch: end of Feb 2017

Example: Business processes embodied as state transition graphs – Trade Finance

Imagine trade finance as

- **states**
  - offer, acceptance, invoicing, downpayment, letter of credit, bill of lading. shipment tracking, reception of shipments, payment, warrantee tracking
- **state transition network embodied in smart contracts**
  - main path is less expensive
  - no emails or pieces of paper; all docs in place
  - everything is logically centralized and accessible by appropriate parties
  - Regulation is in place
- **interoperability with other functional elements**
  - Insurance
  - factoring

The paperless office may finally arrive.

Example: Next Gen Accounting/Compliance Infrastructure

Real-time compliance, accounting and monitoring:

- **Real-time comprehensive auditing**, not sampled.
- **Real-time risk metrics and sensitivity analyses**.
- Real-time overview **dashboard for companies**.
- Real-time overview **dashboard for regulators**.
  - Views and aggregated views of companies, sectors, regions, countries .....
  - **Compliance** is baked into the logic or the smart contracts that underlie all processes.
  - **Regulators will write software specs** and develop tests that compliant software must pass.
  - Organizations using certified software will not be able to break or bend any rules. For 99.999% of transactions, there will be no room for interpretation of words. Code is law.
  - When exceptional conditions arise outside of the anticipated scenarios, the situation can be handled using conventional regulatory and legal mechanisms.

Implications for Financial Services Companies

Real-time, Less Expensive Payment Networks

- **Banco Santander (and other large banks)**
  - **Julio Faura: Can’t build on core banking systems**
  - **Built around and kept in sync with core banking transaction processing**
  - **Parallel system enables more to become more easily programmable**
  - **Stages:**
    - **Interbank payments – DONE (with real money)**
    - **Grow the banking network (in progress)**
    - **Intercompany payments**
    - **Invoicing**
    - **Letters of Credit, Factoring, ….**

Efficiencies that blockchain-based systems bring to financial services: Clearing and Settlement

Clearing and settlement compressed into the instant of the trade (especially for tokenized instruments)

- **Issuance of securities as tokens**
  - Native issuance on the blockchain: T0 (Overstock)
  - Dematerialization of securities into tokens
    - and rematerialization (bidirectional bridge)

- **Tokenization of state-issued currencies**
  - **Fiat-backed**
  - **Price-stable tokens: StabL**

Efficiencies that blockchain-based systems bring to financial services: Proxy Voting

- **Problems with Proxy Voting**
  - Mechanical vote counting has been inaccurate and manipulable (Yahoo!scandal)
  - Unequal rights for shareholders not in attendance at meetings
  - IR Magazine:
    - One corporate secretary of a major company, who declines to be named, lists a myriad of problems: ‘Rule 452 and the death of retail voting; the inability of companies to know the identity of their owners; empty voting and over-voting; the multi-layer proxy delivery process with Broadridge locked in at the center. Issuers have been pushing the SEC for years to take a broad look at the entire stockholder voting process and mechanics. The whole system is in a pre-scandal stage.’

Efficiencies that blockchain-based systems bring to financial services: Proxy Voting

- **Fix for Proxy Voting?**
  - Transparent (yet private) voting on secure non-manipulable blockchain-based voting system
  - Provably fair voting mechanism
  - Identity for shareholders (with configurable privacy)
  - Rules built into the systems to remove ambiguity and abuse

Efficiencies that blockchain-based systems bring to financial services: Reference Data

- **Fixed Income Reference Data Platform**
  - Billions of dollars are spent by many entities cleaning up data
  - This labor can be shared
  - We are building a system that will incentivize financial entities to contribute their fixes for errant data to a shared blockchain database

Efficiencies that blockchain-based systems bring to financial services

- **Constructing and complete life cycle management of complex multiparty structures like syndicated loans**
  - State transition graphs embodied in smart contracts

- **Cross-border payments**
  - Within an organization
  - Among regular counterparties

- **Cost center management**

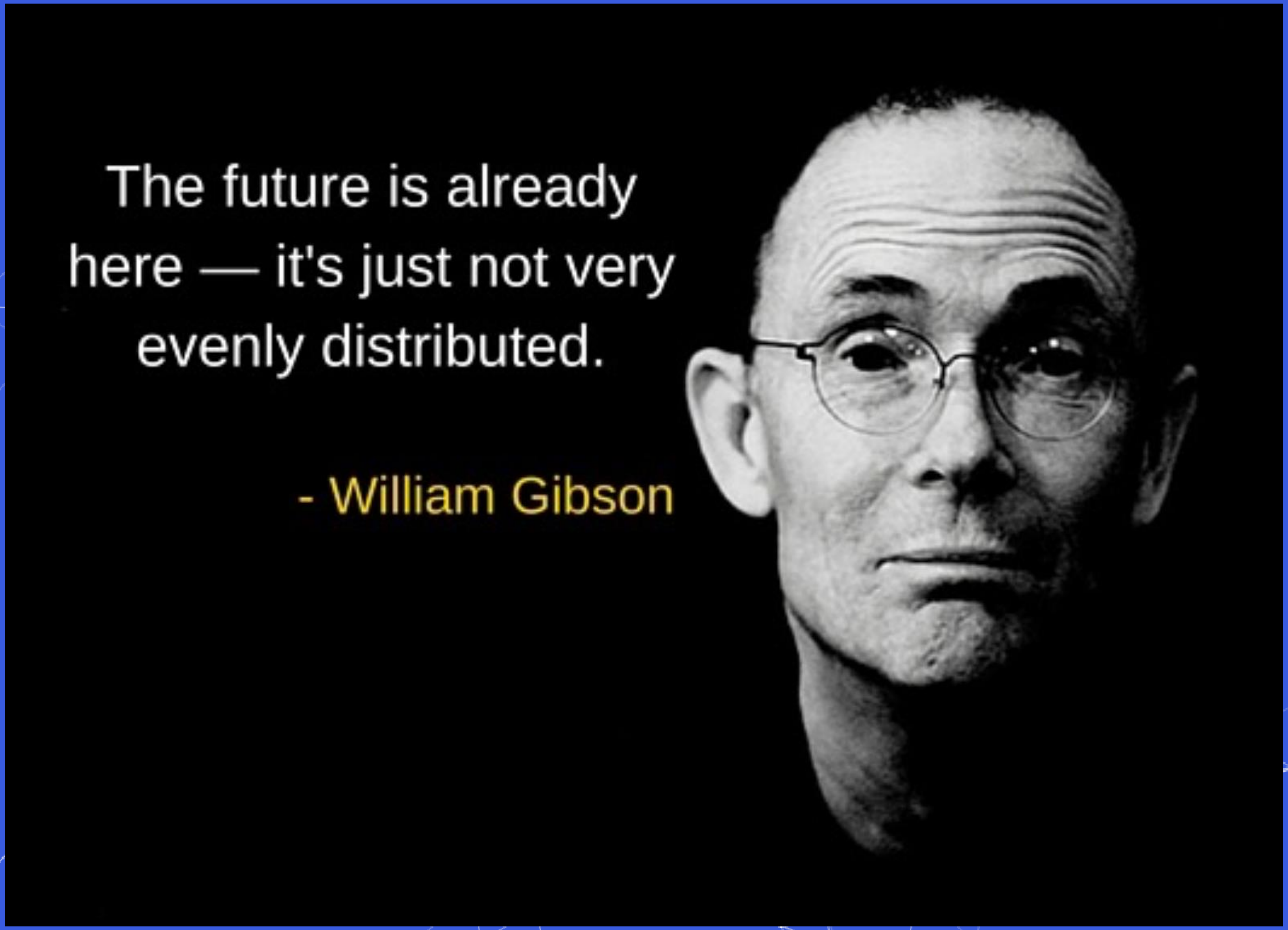
Efficiencies that blockchain-based systems bring to financial services

Once it is possible to coordinate quickly and inexpensively amongst many actors, the crowd will take many of the roles currently filled by large centralized entities like banks/lenders, insurance companies, even central banks.

Marketplace/crowd capital formation for

- **Lending (EtherLoan)**
- **Investing (The DAO is one early (malformed) example, but demonstrates the demand)**
- **Insurance (raise capital pools for conventional approaches, mutual self/insurance)**

All aspects of these processing and value flows will be configurable transparent and not subject to improper manipulation after the fact.



The future is already here — it's just not very evenly distributed.

- William Gibson

This was a ConsenSys.net presentation

Thank you for watching

Better foundation on which to build systems

The Ethereum World Computer is a substrate for building global economic, social and political systems that can be:

- Deeply secure
- Non-repudiable
- Uncensorable
- Natively interoperable
- Transparent (auditable) yet configurably private in certain circu

The Ethereum World Computer represents a strong cryptographic or mathematical foundation on which to build all of our information and decision making systems, rather than the subjective and centralized legal, business, and information systems foundations that lead to siloing and improper manipulation of information and the consequent over-concentrations of power.

Implications for Decentralized Resource Generation and Sharing (Markets)

Open (Industry) Platforms

Resource generation platforms

- **Co-tricity (with RWE/Innogy) / TransActiveGrid** Open Energy Markets Platform
  - Brooklyn-based microgrid
- **Farming** Community Supported Agriculture Platform
- **Ride sharing** (decentralized Uber)
- **Accommodations sharing** (decentralized Airbnb)

Everything can/will be tokenized
- kWh, apples, potatoes, ride-minutes, stay-days, …

Resource Generation Platforms

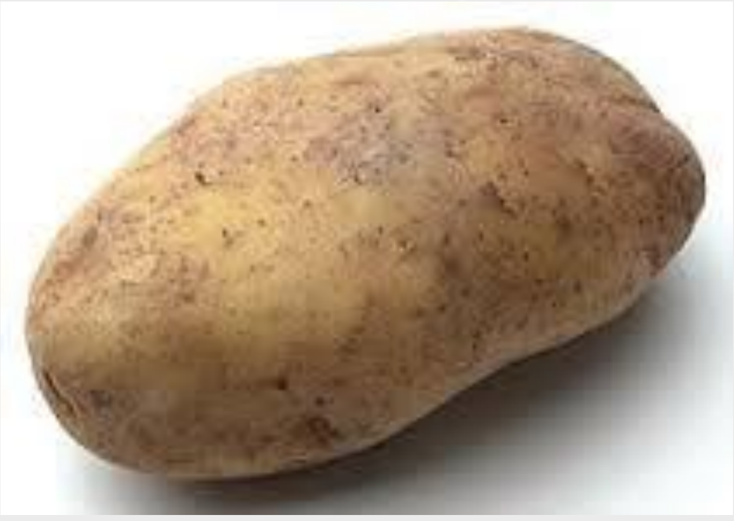
Resource generation platforms

- TransActiveGrid & Farm

- **Same underlying pattern**
- **Generators (PV arrays, farms)**
  - generate a resource (kWh, apples, potatoes)
  - optionally store the resource (Batteries, refrigeration containers)
  - issue tokens against the resource (kWhToken, AppleToken)
  - sell the tokens into the open market which can be redeemed on a spot market for in-the-moment generated product or from storage
  - also issue futures and options so generators can hedge and consumers can plan and provision their resource requirements for specific spans of time

Tokenization and Financialization of Resources (all the things)

When everything is tokenized, and exchange rates among diverse tokens are ubiquitous, barter on decentralized exchanges becomes easy.



ConsenSys's Suite of dApps

ConsenSys has built a number of decentralized applications that are starting to form the foundations of a new kind of business, economic and social ecosystem.

I will discuss some of the implications of these tools for companies and people.

Economic Social Political “Operating System”

- **Because we started before an Ethereum ecosystem existed: ConsenSys and many other devs are building, at the foundation of the application layer of Ethereum, an economic, social and political "operating system”**
  - a set of core components or building blocks on which we can all build applications that will enable the world to run itself according to a horizontal, consensus-driven organizational principle as opposed to the traditional top-down command and control paradigm.