# "Blockchain Technology as a Foundation for a Future Web"



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# When the Web was Invented

- it was a convergence of ideas and current technologies
  - hypertext linking via URIs that leverage TCP/IP
  - markup languages (like SGML)
  - Internet expansion to Europe
  - client-server architectures

# What were the dreams for the Web?

- global collaboration
- a positive use of technology
- empowerment
- societal change (hopefully for the positive)
- free, open, and neutral

But have these dreams been met?

# The Early Web was Simple

- perhaps too simple Ted Nelson
  - simple addressing introduction of URIs
  - decentralized
    - anyone could set up a server, no approval required
    - easy to add content to
    - no link management mechanism to detect missing/ lost content (error 404)
    - no persistence

# Problems Arose Right Away (1/2)

- the false illusion that it was a "global database"
- runaway growth with lack of standardization
- technical disadvantages inherent to any decentralized system
  - local computational limitations
  - susceptability to network unreliability and latency
  - redundant data and lack of synchronization schemes

# Problems Arose Right Away (2/2)

- lack of economies of scale to defray the costs of decentralized systems
- cognitive burden of people managing their own data and how likely it is for this to work reliably for long periods of time at scale
- the tendency of even decentralized systems to assume characteristics of centralized systems because people start using the same pathways

# Web 2.0 brought

- enhanced interactivity
- a boom in Web-based e-commerce
- an explosion in Web-based services, e.g., entertainment
- tools for user collaboration
- more personal data sharing
- the growth of social media
- centralization of content and services leading to "walled gardens"
  "whoever controls the location controls access to the data"
- threats of monopolization

# The "walled gardens"

- most notably "FAANG" in the West
- took the open platform of TCP/IP networks and privatized the layer above it through proprietary interfaces
- data (especially personal) data became a commodity willingly provided by users and out of their control security, privacy, provenance, ownership
- contributed to (but were not solely responsible for) phishing, fake news, trolling/bullying, over-customization, tribalism, etc.

Big tech companies are among the richest and most influential corporations in the world. Once thought of as 'disruptors' they now set the precedent for how things are done in the tech sector and beyond.

How can the powerful tech giants be held accountable when they 'move fast and break things?' "...the Web has failed instead of served humanity, as it was supposed to have done, and failed in many ways... the increasing centralization of the Web ended up producing - with no deliberate action of the people who designed the platform - a large-scale emergent phenomenon which is anti-human" — Tim Berners-Lee, WWW inventor

"We need a Web of the people, not a Web of corporations...there's now more public awareness, and that's the foundation of changing things" — Christian Fuchs, University of Westminster, London

"Will the next Web strengthen the positives of individualism, of equality and of cooperation?" — Paul Jones, University of North Carolina

### How can we (if at all) recover the original dreams of the Web?

- where are today's convergences of ideas and technologies?
- what are the communities that were engendered by the Web?
- how to address the unforeseen issues that have arisen since the early Web and Web 2.0?

# How might a future Web be built?

- as soon as Web 2.0 was introduced, speculation about the next Web began - Web 3.0?
  - Semantic Web emphasis on knowledge/ intelligence
  - Spatial Web immersive interfaces
  - Web of Things Web-like services on the IOT
  - Decentralized Web (DWeb)

A future Web is a "Web of Everything" that encompasses all these concepts semantically and spatially

documents and data

services and things

people and assemblies of items



## The Semantic Web

#### • promises a future where

- all of the world's data/knowledge could be selforganizing semantically without "a master plan" but ultimately supported and available in creative ways
- "open data" is equally accessible to humans and machines via AI and machine learning leading to knowledge and intelligence
- why didn't The Semantic Web as Web 3.0 "catch on?"
  - it went from simple links to attempts at complete knowledge representation to first-order logic

# The Spatial Web

- promises the future of The Semantic Web
  plus
  - all of the world's knowledge can be accessed by immersive and mobile interfaces
  - the contexts of these interfaces can build upon the semantics of the data they access

# The Web of Things

- promises the future of The Spatial Web
  plus
  - access to data from billions of devices/ data sources blinking in and out of existence
  - access to innovative resources and services for sensing, computation, storage, etc.

# The Decentralized Web (DWeb) (1/2)

- promises the future of The Web of Things plus
  - giving users a choice, the same services but decentralized, secure and with user control, privacy, and assurance that their data is safe
  - lack of reliance on large monopolies that amass data for profit and make surveillance possible
  - the ability for users to not only request services, but also provide them
  - user dropout does not impact the system

# The Decentralized Web (DWeb) (2/2)

- requires a decentralized way to store and retrieve the files that compose websites
- decentralized logins so users can interact
- a P2P payment system
- a distributed authentication system to end the need for centralized usernames and passwords

## Constructing these Future Web models

 one of the <u>common</u> (and perhaps most <u>crucial</u>) elements of each of these models is how to define and build "communities of trust" or "communities of agreement/ consensus"



## Consensus/Trust

- <u>consensus</u> suggests <u>agreement</u> even between parties that have no <u>trust</u>
- in distributed systems
  - components are generally trusted e.g., the Website of a company, a search engine, an e-commerce Website
- in decentralized systems
  - there is no single trusted authority
  - components have to coordinate and negotiate trust separately
  - I would not be expected to fully trust a Website such as a social media site or news Website

# Maybe with semantics and consensus/trust comes intelligence?

- Systems now are somewhat intelligent, maybe?
  - biased, unreliable, unavailable
  - not safe, not secure, unaccountable



### A Future Web needs "Communities of Intelligence"





## Enter Blockchain

- Blockchain is perhaps the largest, distributed, successful consensus model in the history of IT
- Blockchain's initial goal was to exchange monetary value in digital environments without a third party
- but aren't Web interactions <u>exchanges of value</u>?; doesn't data provenance have value? don't contracts/ agreements have value?
- could trust-worthy blockchains eliminate the use of proprietary control used (and abused) by the "walled gardens?"

# Blockchains and Trust

- Blockchain is often described as <u>trustless</u>
  ...not necessarily
- it does not <u>eliminate</u> trust but instead <u>minimizes</u> the amount of trust required from any single entity in the system
- this is accomplished by <u>distributing</u> trust among the different entities in the system by forcing them into <u>consensus</u>

# Consider the "paths" for data that have evolved



Could Blockchain be the next logical step?

### Web evolution becomes



"Since Ethereum is run by a non-profit foundation and is open source, then if I'm building on Ethereum, I'm not worried about Ethereum kicking me off the way I would if I were building on Facebook or Twitter" — Chris Dixon, venture capitalist "The future of the Web isn't just about those of us who are online today, but also those yet to connect" — Tim Berners-Lee

# Example - IPFS

- Inter Planetary File System a blockchain-based, distributed, <u>cloud storage</u> service
- instead of storing files at a particular location accessible via a URI, multiple copies, in pieces, are distributed across many machines
- "pieces" prevents the centralization of data
- Filecoin is the incentive for use
- IPFS, the company, supports the technology but has no control over the content stored on the network



...as companies have become subject to increased scrutiny, public trust has shifted and the conversation has turned to what kind of social contract we demand from them

### Suppose your family history, personal preferences, etc. was on a blockchain?

- users would control
  - content
  - preferences
  - visibility
- would this undercut the profit models of the monopolies?
- allow users to negotiate the use of their data

### There is a similar idea in Tim Berners-Lee's Solid infrastructure

- designed in response to loss of original Web goals
- not based upon blockchain but reflects similar motivations
- is directed towards a decentralized Web
- personal data is stored in <u>Pods</u> (personal online data stores)
- users control where Pods are stored
- authenticated applications are allowed access to Pods with permission of the owner



# Concept appears again in the DApp Stack



# Decentralized Applications (DApps)

- generally are smart contracts + cryptocurrency + a blockchain + an application
- functions similar to traditional apps but differ in how users are incentivized and data is stored
- unlike traditional applications, DApps are also controlled by and funded by their users e.g., Ethereum, Bitcoin
- significant because the infrastructure behind the application is on a blockchain meaning that it is public for all users to see







#### October 4, 2021

92 Comments

**Facebook** and its sister properties **Instagram** and **WhatsApp** are suffering from ongoing, global outages. We don't yet know why this happened, but the how is clear: Earlier this morning, something inside Facebook caused the company to revoke key digital records that tell computers and other Internet-enabled devices how to find these destinations online.



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We're aware that some people are having trouble accessing our apps and products. We're working to get things back to normal as quickly as possible, and we apologize for any inconvenience.

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9:22 AM · Oct 4, 2021

♡ 174.7K

(j)

# DApp Example



application runs on equivalent nodes each controlled by a different entity



### Powering Communities and Opportunities

Steem is a social blockchain that grows communities and makes immediate revenue streams possible for users by rewarding them for sharing content. It's currently the only blockchain that can power real applications via social apps like Steemit.

# Possible advantages of a blockchain-based Web

- use of links that identify and retrieve data based on content rather than where it is stored and controlled (like URIs currently do)
- content can be stored (completely or in parts) and passed around multiple computers on a P2P network
- links would be persistent due to lack of dependence on location - <u>no more 404s</u>!

# Possible disadvantages of a blockchain-based Web

- without the big online intermediaries to exercise central control, could abuse (censorship, harassment, hate speech) increase?
- would/could dark, illegal, hidden Websites and content share the same status as others?
- what would prevent (if appropriate) the growth of alternative, interoperable blockchains (parallel Webs)?
- what about governance and standards such as the IETF or W3C?

### Maybe Blockchain can provide some solutions, but let our research be more focussed towards a better Web for all

#### **Governments will**

- Principle 1 Ensure everyone can connect to the internet
- Principle 2 Keep all of the internet available, all of the time
- Principle 3 Respect and protect people's fundamental online privacy and data rights

#### **Companies will**

- Principle 4 Make the internet affordable and accessible to everyone
- Principle 5 Respect and protect people's privacy and personal data to build online trust
- Principle 6 Develop technologies that support the best in humanity and challenge the worst

#### Citizens will

- Principle 7 Be creators and collaborators on the web
- Principle 8 Build strong communities that respect civil discourse and human dignity

Principle 9 – Fight for the web

- The right to be informed as to what data will be collected, and how it will be used
- The right to opt out of data collection or sharing
- The right to be told if a website has data on you, and what that data is
- The right to be forgotten; to have all data related to you deleted upon request
- The right to be informed if ownership of your data changes hands
- The right to be informed of any data breaches including your information in a timely manner
- The right to download all data in a standardized format to port to another platform

### 30th International Conference - WWW/Internet - 2031

Maybe this is the Web we'll be talking about at this conference!

Hope to see you there!

#### Thank You!

# Please send your questions and comments to:

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