PARADIGM SHIFT:
DATA TOGETHER
COMMUNITIES USING DECENTRALIZED TECHNOLOGIES TO MAKE A BETTER WEB

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DECENTRALIZED WEB

Source: On Distributed Communications Networks, Paul Baran, 1962
The internet has been stolen from you. Take it back, nonviolently.
DATA TOGETHER
COMMUNITIES USING DECENTRALIZED TECHNOLOGIES TO STEWARD DATA

A MODEL FOR DECENTRALIZED ACTIVITIES
A VIEW ONTO DECENTRALIZED ACTIVITIES
TOOLS FOR DECENTRALIZED ACTIVITIES

PUBLIC RECORD
COMMUNITIES, COLLECTIONS

ACTIVITIES: HARVESTING, MONITORING, STORING, ANALYZING, RESCUING …
WHAT DO THESE HAVE IN COMMON?
PRECARIOUS WEB
Someone puts a file on a server and passes around an http link that points to the server.

**THE LOCATION-ADDRESSSED FARCE**

MANY DOWNLOADS = MANY COPIES, BUT LOCATION-ADDRESSSED LINKS PRETEND THERE'S ONLY ONE VALID COPY
Many people download the file. Now there are many copies of the file — all of the downloaded copies.
THE LOCATION-ADDRESS FARCE

MANY DOWNLOADS = MANY COPIES, BUT LOCATION-ADDRESS LINKS PRETEND THERE'S ONLY ONE VALID COPY

... But we pretend that there's still only one copy
Endangered Data
Woven into a Precarious Web

**precarious** adj. Dangerously lacking in security or stability: *a precarious posture; precarious footing on the ladder.*

**adj. Subject to chance or unknown conditions.**

Centralization is a disease that the web is suffering from. It makes the web unstable, insecure and vulnerable to exploitation. We can address that disease by changing the way we link to information.
Benefit: If anyone on the network has a copy of the content you will be able to find and retrieve it.
Key idea: It doesn’t matter where the content is stored. What matters is being able to know that you’re getting exactly the content you requested.

*also important to consider who you got the link/address from.
CONTENT ADDRESSING

How: identify content by its cryptographic hash
CORE CONCEPT

CONTENT ADDRESSING

**Benefit:** If anyone on the network has a copy of the content you will be able to find and retrieve it

**Key idea:** It doesn’t matter where the content is stored. What matters is being able to know that you’re getting exactly the content you requested*

**How:** Identify content by its cryptographic hash

*also important to consider who you got the link/address from.
THE KEY:

HASH-LINKED DATA STRUCTURES
SOME TOOLS THAT USE
HASH-LINKED
DATA STRUCTURES

- git
- Apache Spark
- BitTorrent
- IPFS
- bitcoin
- Ethereum
A benefit of hash-linking: cryptographic integrity checking.

When resolving a link, you can use the link value (a hash) to validate the result. This allows wide, secure, exchanges of data (e.g., Git or BitTorrent).
A benefit of hash-linking:

Immutable data structures

Data structures with hash links cannot mutate. This is useful for versioning, for representing distributed mutable state, and for long term archiving.
A BENEFIT OF HASH-LINKING:

DECOUPLE CONTENT FROM LOCATION

DECOUPLE WHERE THE CONTENT IS STORED FROM THE IDENTITY OF THAT CONTENT, SO THAT DATA CAN EXIST IN MANY PLACES AND PASS THROUGH MANY HANDS WITHOUT LOSING INTEGRITY
PUTTING IT TOGETHER

CONTENT-ADDRESSED PROTOCOL

examples of links to a hash “QmZt34a”:

- **dweb:/ipfs/QmZt34a**
- **dweb address space**: general address space for decentralized protocols
- **http://ipfs.io/ipfs/QmZt34a**
- **http gateway**: IPFS nodes expose an http interface that is a gateway to the p2p IPFS network

*also important to consider who you got the link/address from.*
STORING DATA TOGETHER
“This information is important to me. Please hold a copy at the library.”

“This information is important to me. I have a copy, in case anyone needs it.”

“I’ve got some spare storage. I’ll help preserve a little piece of the stuff we all care about.”
Primers:
In order to make our archiving efforts as thorough and systematic as possible, we use Agency Archiving Primers to identify key programs, datasets, and documents that are vulnerable to change and loss. Primers are composed of sources, which each specify a url as a starting point for archiving.

HUD
US Department of Housing & Urban Development
17014 urls
914 / 3115 completed

NASA
National Aeronautics and Space Administration
0 urls 0 / 0 completed

NOAA
National Oceanic and Atmospheric Administration
0 urls 0 / 0 completed
Environmental Protection Agency

The mission of the Environmental Protection Agency is to protect human health and the environment through the development and enforcement of regulations. The EPA is responsible for administering a number of laws that span various sectors, such as agriculture, transportation, utilities, construction, and oil and gas. In the budget for FY 2017, the agency lays out goals to better support communities and address climate change following the President’s Climate Action Plan. Additionally, the agency aims to improve community water infrastructure, chemical plant safety, and collaborative partnerships among federal, state, and tribal levels.

Sources:

EPA Open Data
0/1061

Hazardous Air Pollutants
0/0

epa.gov
2272/43273

Environmental Dataset Gateway
4/1019
WHAT DO THESE HAVE IN COMMON?
Communities

Harvesting
Monitoring
Storing
Analyzing
Rescuing

Data, Together
The Public Record
DISTRIBUTED WEB MENTALITY

BECOME “MERELY” PEERS — VALUED PEERS, WITH THE RESOURCES OF INSTITUTIONS.
IPFS: CONTENT-ADDRESSED PROTOCOL TO REPLACE HTTP

ipfs.io
FILECOIN:
TOKEN-POWERED
DECENTRALIZED
STORAGE NETWORK
filecoin.io
IPLD: ABSTRACT DATA MODEL FOR ALL HASH-LINKED DATA STRUCTURES

ipld.io