A system for distributed minting and management of persistent identifiers

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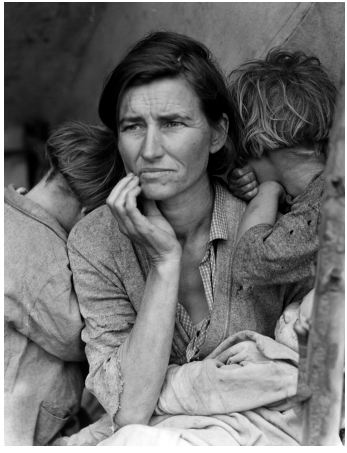
Motivation and vision

The problem

Truly long-term persistence of identifiers should account for risks to managing organizations' longevity.

- Internal risks: solvency, good will.
- External risks: political, economic, military.



The approach

Decentralize!

First steps already taken: w3id is based on a **social contract** between several managing organizations.

We can **do even better** (in terms of security, scalability, robustness), thanks to two great innovations in computer science: **public-key cryptography** and **P2P networks**.

Peer-Minted Persistent Identifiers (PMPIs)

Introducing Peer-Minted Persistent Identifiers (PMPIs), a distributed system in which **anyone can mint** and manage their IDs. The entire database with **full history is public** and **stored in many copies** (LOCKSS-like approach to long-term preservation).

If you know **Bitcoin**, keep this **analogy** in mind throughout this talk:

PMPI	is to	a traditional PID (backed by a minting org.)
	as	
Bitcoin	is to	a traditional currency (backed by a central bank)

Business models

Monetizing **trust and QoS** instead of **being first**.

Vision: the PMPI protocol as a common good, with multiple stakeholders building their business models around it.

Analogy: the Internet Protocol is a common good, yet we have for-profit and non-profit organizations offering their services on top of it (ISPs, domain names, hosting, SSL certificates).

Technical details

Desired properties of the system

- Anyone can mint an ID and associate with it a URL to content + a list of authorized keys.
- For a given ID, any authorized key owner can alter the URL and the list of authorized keys.
- Anyone can download the complete set of IDs with full revision history and verify its integrity.
- No proper subset of participants is capable of shutting down the system.

Chain of operations

An **operation** is the basic building block:

- mint a new identifier (set the URL to metadata + the list of authorized keys)
- update an identifier (change the URL to metadata + the list of authorized keys)

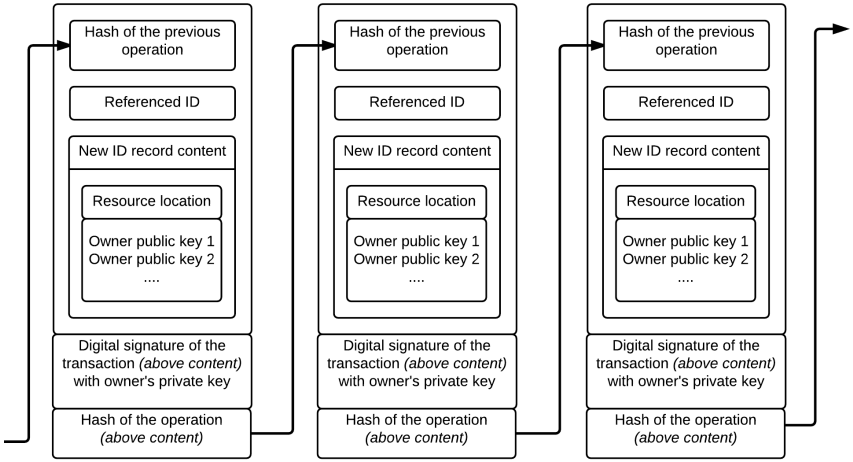
Operations form a **chain**, each operation is signed with an authorized private key, each includes the hash of the previous operation in the chain.

(Operations are immutable, tampering with the past is practically impossible)

Adding an operation to the chain requires a **proof-of-work**.

(Prevents spam and gives time to propagate operations across the network — we want a chain not a tree)

Chain of operations



More technical details (and differences wrt. BTC/NMC)

For the sake of mass imports/modifications, users with **high reputation** (many operation earlier in the chain) can add **multiple operations** in one bundle (w/ one proof-of-work).

Certain useful actions, e.g. **blacklisting** a known offender, or **reclaiming** a long-lost key, should be agreed by the community. For that purpose, key owners may **vote for motions**, the votes are yet another type of operations that are added to the chain.

(X% of users, weighted by operations, have to agree for a motion to pass)

Authorized keys for a given identifier can be differentiated by **roles**. This will enable **delegation of concerns** to various third-party service providers.

Next steps

Roadmap

- Find interested stakeholders
  (libraries, archives, minting orgs., research centres)
- Secure funding
  (most likely public research funding agencies)
- Implement and deploy
- Maintain and promote

Fine-tuning

Several parameters in the protocol need to be calibrated. Where applicable, by further research and simulations. In other cases, by consensus.

- Fine-tune the hardness of proofs-of-work
- Establish a catalogue of roles for auth. keys
- Quantify benefits of high reputation
- Agree on the P2P network topology

Thank you for your attention. Let's stay in touch!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