

# BRINGING DECENTRALIZATION TO YOUR DOORSTEP: 5 Years in Browsers

*Michelle (Mosh) Lee  
IPFS Foundation  
FOSDEM, February 2026, Brussels*

# IPFS Project



- Started in 2015 with two simple, radical ideas:  
**Content addressing**, all the way down, creates self-certifying data.  
**Decentralized networks** shaped by users, not platforms.
- Today, a family of protocols to store, verify, and share data across distributed networks – the building blocks for a better web.

# People use IPFS for 3 main reasons:

## 1. Resilient Public Network

Peer-to-peer public network for all. 5+ billion files.

Resilient to censorship and outages.

*Content discovery + routing*

*Data transfer*

*Data verification*

*Pinning + persistence*

*Browser support for ipfs:// + more*

## 2. Private/Permissioned Data Sharing

Networks for collaborative archiving, large-scale scientific collaboration, local enterprise networks, & more.

*Everything from public + roll-your-own gateways  
ipfs-cluster  
ipfsspec  
& more*

## 3. Content Addressing

Building blocks for content addressing the whole damn internet. Small, fast, interoperable. BYO networking.

*IPLD*

*Content-Addressed Archives (CAR)*

*DASL + RASL + MASL*

*CID Congress series*

*Interop w/ WARC, ZARR, etc.*

# IPFS Timeline 2015-2025

- 2015 go-ipfs alpha
- 2017 Turkish Wikipedia & Catalan referendum sites mirrored on IPFS
- 2018 Pinata launches
- 2019 IPFS Camp #1 (Barcelona)
- 2020 Filecoin network launch
- 2021 IPFS in Brave browser, NFT boom, Shoah Foundation verifiable archives
- 2022 IPFS Camp #2 (Lisbon)
- 2022 Taiwan's MODA site mirrored on IPFS
- 2023 Renames: go-ipfs → kubo, js-ipfs → helia, IPFS Thing #2 (Iceland)
- 2023 IPFS goes to space in p2p satellite comms
- 2023 Bluesky launches using IPLD
- 2024 helia/verified-fetch released
- 2024 Rise of the mini-libs: DASL, atcute, dag-cbrrr, rust\_cid\_npm
- 2025 Over 5 billion files on IPFS, 41 million Bluesky users of IPLD, ATProto

# IPFS makes computing & the web...

More open

Taiwan's Ministry of Digital Affairs (MODA) is in the process of integrating the InterPlanetary File System (IPFS), a piece of Web3 technology used for



EUREKA STREET

INTERNATIONAL

## Inside Catalonia's cypherpunk referendum

06 October 2017

BUSINESS • TECHNOLOGY

## Turkey Can't Block This Copy of Wikipedia

'The internet is the planet's most important technology'

By Brady Dale • 05/10/17 7:21am



[Blogs](#) | [Information democracy](#) | [Freedom of expression online](#)

## No justification for internet censorship during Catalan referendum

By EDRI • October 4, 2017

# IPFS makes computing & the web...

More open

Taiwan's Ministry of Digital Affairs (MODA) is in the process of integrating the InterPlanetary File System (IPFS), a piece of software that allows users to store and share data in a decentralized manner.

**Filecoin Foundation Successfully Deploys InterPlanetary File System (IPFS) in Space**

Jan 16, 2024

One small step  
for IPFS...

Filecoin Foundation



LOCKHEED MARTIN

More efficient

IPFS Camp

July 12th, 2024

Storacha x 3s Game Studio: Decentralized storage powering games via Unreal plugin

GAMING & STREAMING

Alexander Kinstler, Adam Grodzki

Copy of



less net work for  
networks

Iroh is a library for building on direct connections between devices, putting more control in the hands of your users.

START NOW

DOCUMENTATION

# IPFS makes computing & the web...

Maharashtra govt onboarded blockchain tech for issuing COVID-19 test certificates

The Maharashtra government, not the onboarded startup, will own and control the data and

## More open



Exposing the Truth:  
How Numbers Protocol is  
Revolutionizing War Crime  
Investigations with  
Starling Lab and Rolling Stone

Data	
Registration	<a href="#">Download</a>
Date	July 18, 2023
Time	20:00:00 UTC
Registered By	Ada Lovelace
stored On	ipfs://.../938149

At the 'Biodiversity Olympics,' scientists work to democratize rainforest tech

ABHISYANT KIDANGOOR  
29 AUG 2024 AMAZON

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Join us in exploring new ways to protect journalism's most important documents for the future

By distributing how we host primary source materials, news archives and more, we can eliminate single points of failure

Written by Sanjin Ibrahimovic

Edited by Amanda Hickman and Samantha Sunne

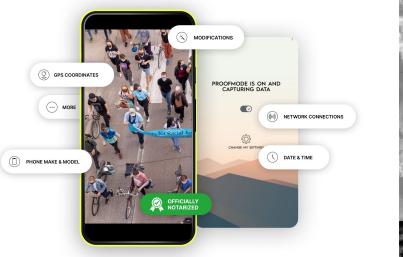
We at DocumentCloud, with support from the Filecoin Foundation for the Decentralized Web, are uploading documents for long-term preservation and distribution via the Filecoin network and the InterPlanetary File System (IPFS).



## More credible

ProofMode Provides  
Verifiable Camera App  
2024 US Election

29 October 2024



## More efficient

# IPFS makes computing & the web...

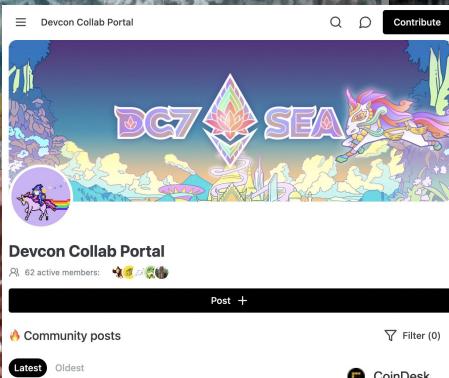
Maharashtra govt onboard blockchain tech for issuing COVID-19 test certificates

The Maharashtra government will onboard a startup, will own and control the data and...

More open

Taiwan's Minister of the Interior Interplanetary File System (IPFS) is revolutionizing the way we...

Exposing the Truth: How Numbers Protocol is Revolutionizing War Crime Investigations with Starling Lab and Rollin...



More fun

Huddle01, Blockchain Video Conferencing Project Tries to Outdo Zoom, Targets \$37M Node Sale

Huddle01, a blockchain project to provide decentralized audio and video conferencing – aiming to provide lower latency virtual meetings than...

1 month ago



More credible

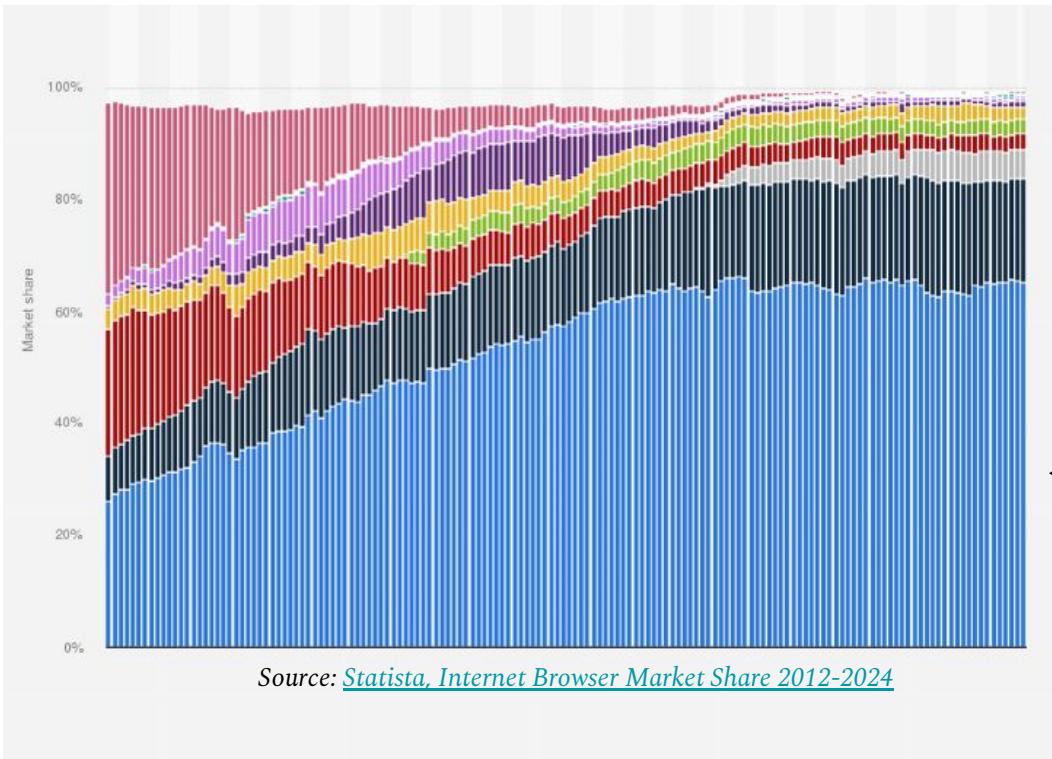
## Bluesky Signups Soar By 1 Million After X is Banned in Brazil

The decentralized alternative to X is flooded with new users and sees 15 times its normal traffic over the weekend.

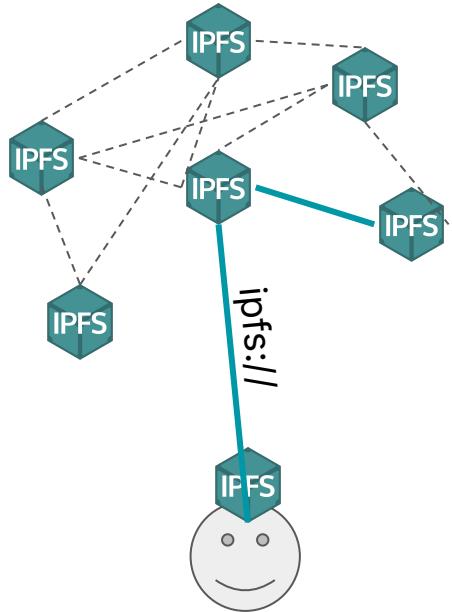


More efficient

# ..through a consolidating browser landscape!



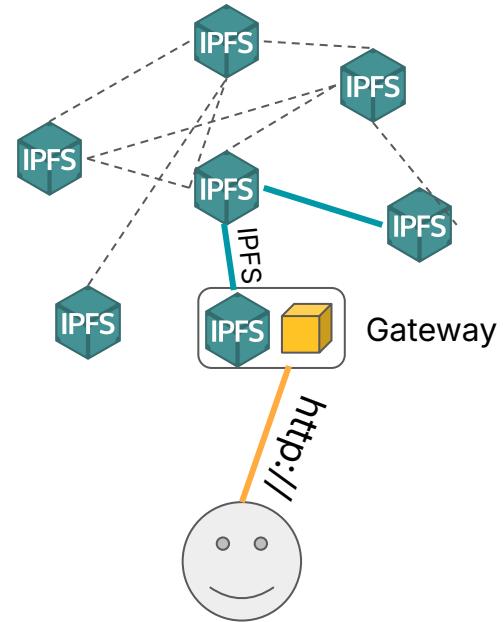
# P2P: Theory Meets World



By design, your node talks to other nodes to find & fetch content by CID.



In practice, most web users aren't running a node.  
50-100 apps installed, 7-10 daily use.  
87% of Chrome extensions have <1,000 installs. IPFS Companion: 50,000.



So in 2018 we introduced gateways (computers that speak both HTTP and IPFS).

# P2P: Theory Meets World

ipfs://cid

*The ideal way. Most  
browsers don't support this  
yet.*

https://ipfs.io/cid

*Most users don't have IPFS  
clients installed, so webapp  
devs hardcode gateway URLs.*

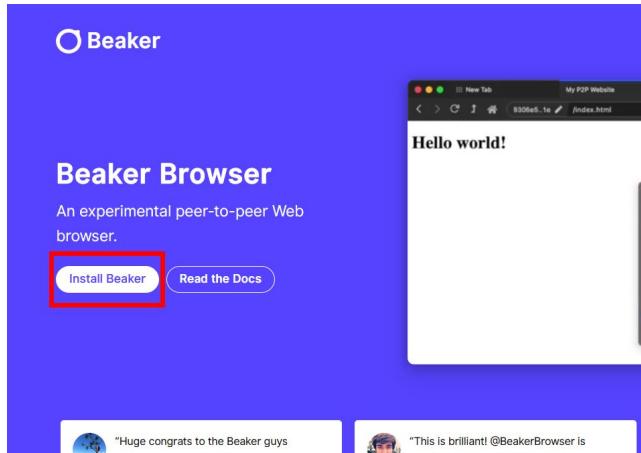
*Re-centralization: 2 billion  
files at peak, 1-4 gateways.*

```
{  
  imageCID: CID(QmbF8cCC478X8ux1e4TLTH8jtGZkyWmGT6BpYMuP8HtGUR),  
  metadataCID: CID(QmV7P6QdN3geyyNxGQ5MYpa8sc7arA8kigiK5pV27xJNUx),  
  mintedNFTId: '1',  
  metadataURI: 'ipfs://0nV7P6QdN3geyyNxGQ5MYpa8sc7arA8kigiK5pV27xJNUx',  
  metadataJSON: {  
    name: 'Screenshots',  
    description: 'Medium & Twitter Screenshots',  
    image: 'QmbF8cCC478X8ux1e4TLTH8jtGZkyWmGT6BpYMuP8HtGUR'  
  },  
},
```

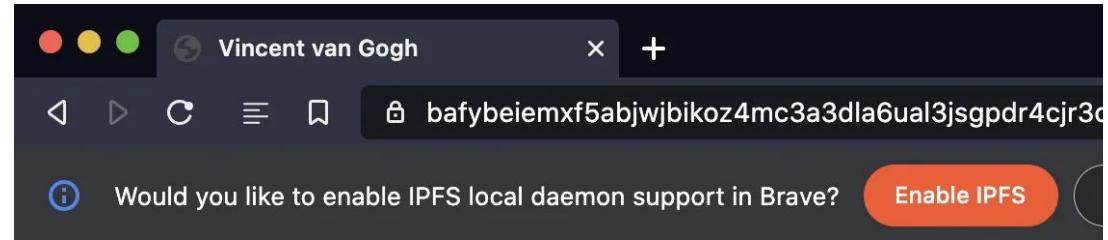
```
22 | ipfs.files.add(files, function(err, files) {  
23 |   // 'files' will be an array of objects containing pat  
24 |   if (err) {  
25 |     console.log(err);  
26 |     log(err);  
27 |   } else {  
28 |     console.log(files);  
29 |     document.getElementById('output').innerHTML = "<b>" +  
30 |     <a target='new' href='https://ipfs.io/ipfs/" + files<br>  
31 |     " + "<a target='new' href='http://ipfs.coinkmarketrank  
32 |   }  
33 | })
```

**0k, so let's make browsers more P2P.**

# Approach 1: New browsers that embrace Web3



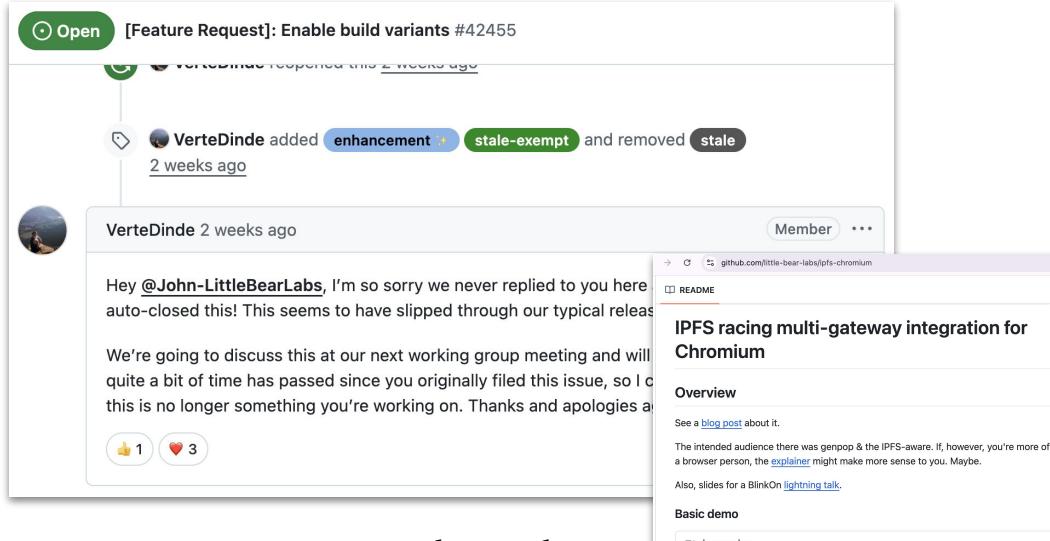
Beaker (`dat://`)



Brave (`ipfs://`)

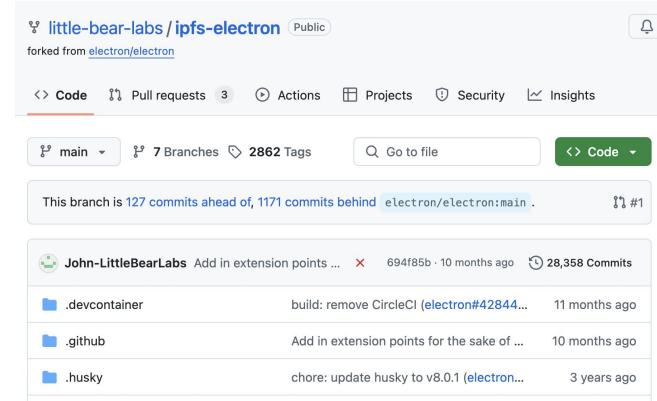
...but it's hard to get people to switch browsers.

## Approach 2: Add ipfs:// to popular browsers



Issues getting response, but only after 1 year

## *Chromium fork*



## Electron fork (ipfs://)

...but browsers are (rightly) cautious and progress is slow.

# Approach 2: Some successes, but slow.

Intent to Ship: Ed25519 in Web Cryptography 1,122 views



Javier Fernandez  
to blink-dev

Contact emails  
jfern...@igalia.com

Explainer  
<https://github.com/WICG/webcrypto-secure-curves/blob/main/explainer.md>

Specification  
<https://w3c.github.io/webcrypto/#ed25519>

Design docs

Blog & news

Adding IPFS  
Protocol  
Support to  
Chromium

Dietrich Ayala  
14 November 2022

*2022: Pre-defined custom protocol  
handlers in Chromium*



*Summer 2025: Ed25519 shipped in Chrome!*

**...we need another path in parallel.**

# Approach 2: Want to help?

## Browsers & Standards Work 2026: Call for Community Input

■ Ecosystem and Usage



mosh

TL;DR: IPFS is planning the next phase of work to make browsers better for the decentralized web – not just IPFS, but any protocol that needs lightweight crypto, peer-to-peer connections, or native browser integration. We need your input on what features matters most.

### Background: What We've Accomplished

Over the past 5 years, sustained collaboration with [Igalia](#) has delivered real improvements to all major browsers:

- [Ed25519 in WebCrypto API - Shipped in Chrome 137](#) (May 2025), now available in 79% of browsers. This eliminates the need to bundle crypto libraries for signature verification, reducing bundle sizes significantly for projects using content-addressing, decentralized identity, or verifiable credentials.

Dec 2025

Dec 2025

1 / 6

Dec 2025

23d

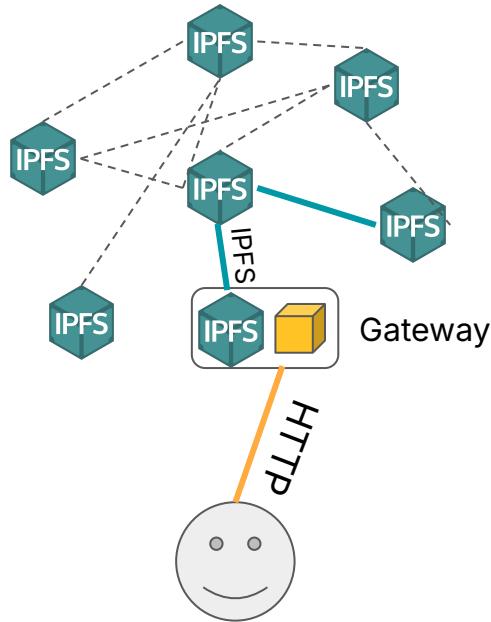
*Do you like streaming hashing in WebCryptoAPI? BLAKE3?*

*Want to webkit to fix localhost bugs? Remote attested TLS?*

*Share your needs and use cases in the discuss.ipfs.tech forum thread.*

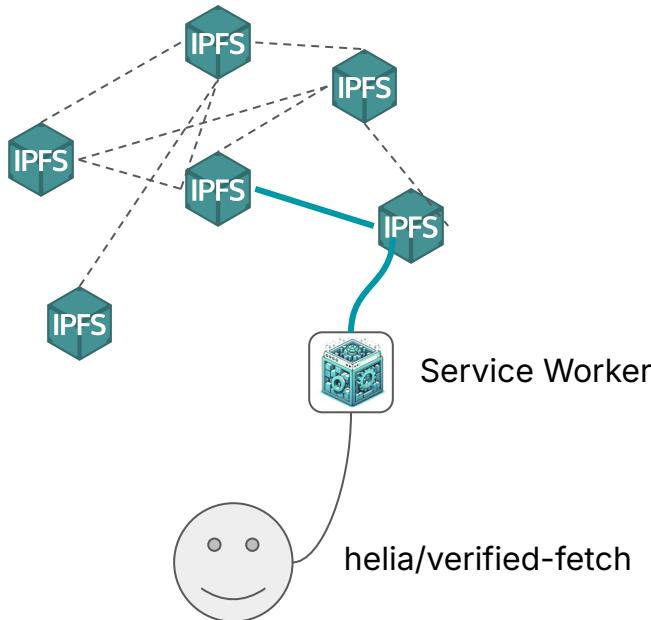
# Approach 3: New use of old browser capabilities

*Service Workers – a scriptable network proxy in a web browser that manages network requests*



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*Service Workers – a scriptable network proxy in a web browser that manages network requests*



## IPFS Drop-in Service Worker Example

Replace centralized IPFS gateways with resilient and verified retrieval gateways or providers with [@helia/verified-fetch](#) in a drop-in Service Worker.

This example shows how to use a Service Worker to intercept requests to centralized IPFS gateways and retrieve content directly from providers (or self-hosted gateways) with [@helia/verified-fetch](#).

For more information, check out the [deep dive video on YouTube](#).

The **helia/verified-fetch** library within a Service Worker facilitates direct verified retrieval of content-addressed data.

# Approach 3: The Post-Gateway Future



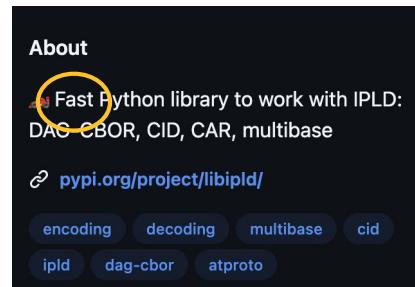
- (Now) App devs can add drop-in service workers. Possibilities abound!
- (Soon) [ipfs.io](https://ipfs.io) gateway experiments to add service workers that push more traffic to true p2p. Progress, monitoring, and metrics published.
- (Late 2026) Expect some rate limiting on gateways.
- Spread the load so the public network can be a true p2p commons.

# Approach 4: Don't, Actually

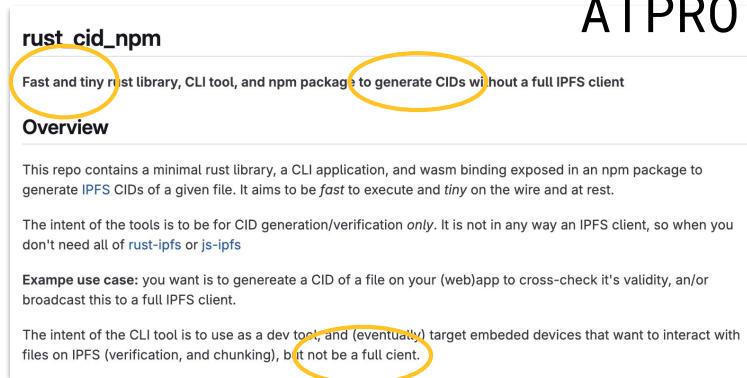
*Servers are acceptable if your data is content-addressed + you decentralize who controls the servers.*



mary @mary.my.id · 1mo  
3kb minzipped for my cbor library vs. 6kb for cborg and 11kb for ipid/dag-cbor (which wraps cborg)  
2 7 ...



About  
Fast Python library to work with IPLD: DAG-CBOR, CID, CAR, multibase  
[pypi.org/project/libipld/](https://pypi.org/project/libipld/)  
encoding decoding multibase cid  
ipld dag-cbor atproto



rust\_cid\_npm  
Fast and tiny rust library, CLI tool, and npm package to generate CIDs without a full IPFS client  
Overview  
This repo contains a minimal rust library, a CLI application, and wasm binding exposed in an npm package to generate IPFS CIDs of a given file. It aims to be *fast* to execute and *tiny* on the wire and at rest.  
The intent of the tools is to be for CID generation/verification *only*. It is not in any way an IPFS client, so when you don't need all of `rust-ipfs` or `js-ipfs`  
Example use case: you want to generate a CID of a file on your (web)app to cross-check its validity, and/or broadcast this to a full IPFS client.  
The intent of the CLI tool is to use as a dev tool, and (eventually) target embedded devices that want to interact with files on IPFS (verification, and chunking), but not be a full client.

← COMMUNITY-DRIVEN  
MINI LIBS for CIDs &  
CBOR, MANY FROM  
ATPROTO DEVS



# Approach 4: Don't, Actually

*Servers are acceptable if your data is content-addressed + you decentralize who controls the servers.*

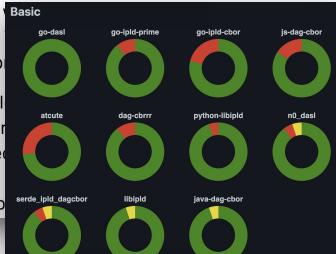
**DASL – Data-Addressed Structures & Links** **WHAT** **HOW** **CODE** **SPECS**

**WHAT IS THIS?**

DASL ("dazzle") is a small set of simple, standard primitives for working with content-addressed, linked data. It builds on content addressing, a proven approach used in Git and IPFS to create reliable content identifiers (known as CIDs) through cryptographic hashing. Content addressing enables robust data integrity checks and efficient networking: systems can verify they received exactly what they asked for and avoid downloading the same content twice. The linked data part lets you link to stuff by its hash. You can build very big graphs with these primitives, such as the graph behind Bluesky.

We call DASL "data-addressed" because it supports a data serialization component that makes [content-addressing](#) sweet and easy when working Basic by subcomponents of the [IPFS](#) universe, but simplified to costs, and work well with the web. More specifically, our plan

- **pave the cowpaths:** we focus on supporting what people actually use. This takes over any consideration of theoretical purity. We're retconning the spec to what people should be.
- **extensibility vs optionality:** extensibility is important for



← YOU MADE US WRITE A  
LIGHTER-WEIGHT IPFS  
FAMILY SPEC CALLED  
✨ DASL ✨

ROBIN @ 3:15p  
DECENTRALIZED COMM  
DEVROOM

# THE HILLS ARE ALIVE



**WITH A DECENTRALIZED DATA OWNERSHIP AND ARCHITECTURE  
STRATEGY DRIVEN BY THE TREATMENT OF DATA AS A PRODUCT  
AND FEDERATED GOVERNANCE WITHIN A SELF-SERVE INFRASTRUCTURE**

# Acknowledgements

*All 4,000+ IPFS contributors*

*Dietrich Ayala*

*Lidel*

*Javier Fernandez*

*John Turpish*

*Web Transitions*

*Igalia*

*IPFS Foundation*

*Little Bear Labs*

*Shipyard*

*Protocol Labs*

*Chromium, Gecko, Webkit*

*Juan Benet*

*...and more.*

# Contact

*Email: mosh@ipfs.io*

*Bluesky: @mosh.bsky.social*