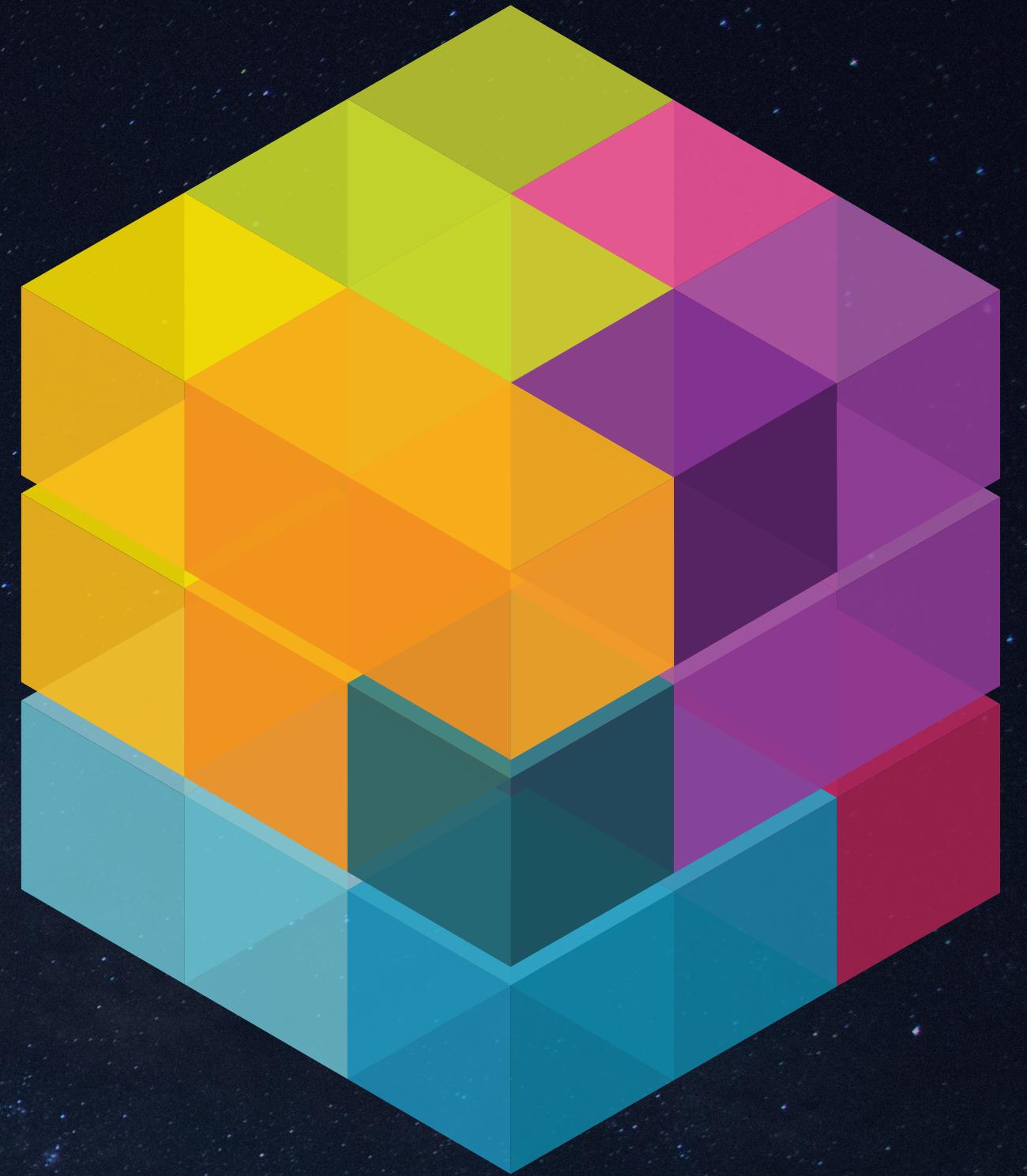


# LIBP2P: WHAT'S UP & WHAT'S NEXT?

@ Devcon5 🙌

Raúl Kripalani

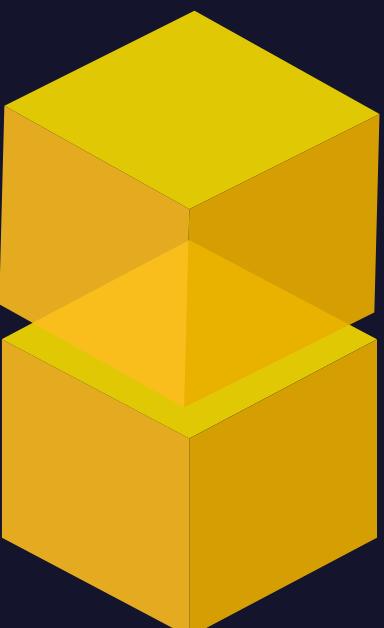


libp2p

today

# AGENDA

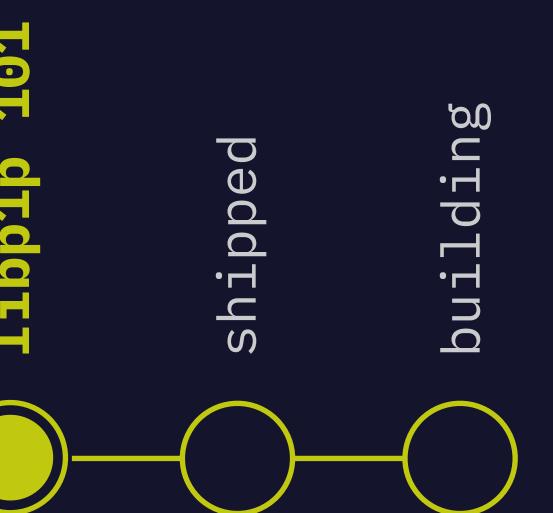
- ▶ libp2p 101 (5 min)
- ▶ shipped 🚢 (~7 min)
- ▶ building 🐥 (~7 min)





libp2p @ devcon5

# LIBP2P 101





# A MODULAR PEER-TO-PEER NETWORKING STACK

Composable building blocks to assemble ***future-proof p2p networking layers***.

Runs on many runtimes: server, browser, mobile (experiments). soon: embedded.

Originated in IPFS. Implemented in 7 languages; bustling cross-project community.

Created, stewarded and sponsored by PL; owned by the community. It's a public good.

Licensed under MIT, soon Permissive License Stack (ASLv2 + MIT).

# DECENTRALIZED PROCESS ADDRESSING

libp2p's grand vision is the ability to **locate**, **connect**, **authenticate**, **negotiate** and **interact** efficiently with any process in the world, ***no matter the runtime*** (server, browser, IoT, embedded, etc.) so long as its ***identity is cryptographically derived from its public key***; and have all of that happen in a ***seamless manner*** (e.g. NAT, relay, packet switching), even as those processes **relocate**, **roam**, **evolve** and **mutate over time**. It is ***juxtaposed to endpoint addressing*** (e.g. IP networks).





# libp2p



Transports



Multiplexers



Secure Channels



Peer Discovery



Pubsub



NAT Traversal



Peer Routing

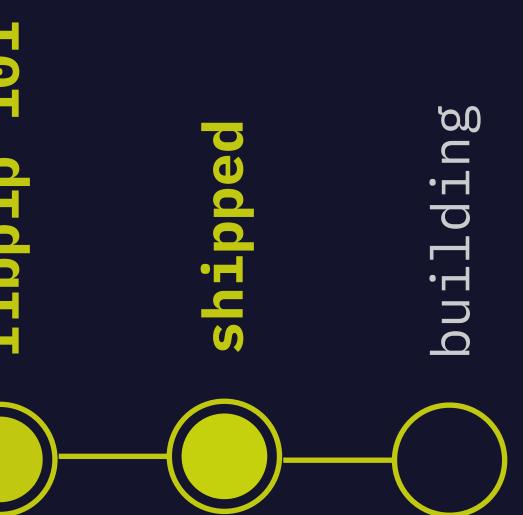


Content Routing



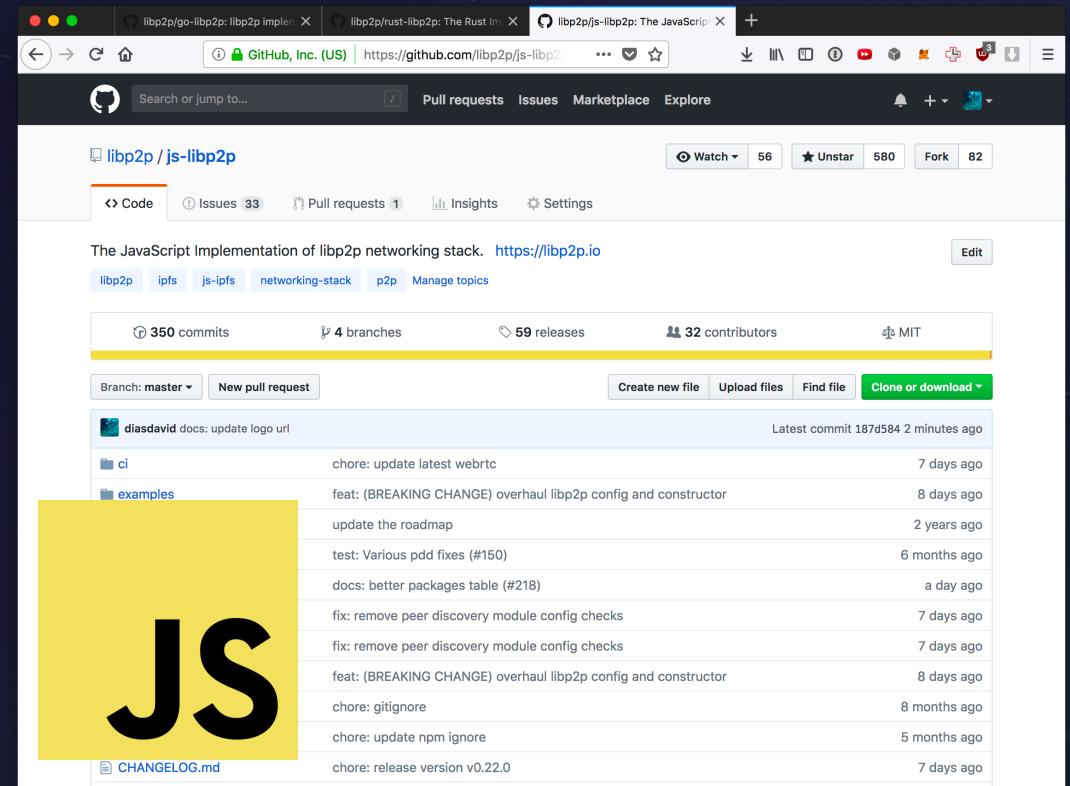
libp2p @ devcon5

**SHIPPED!** 



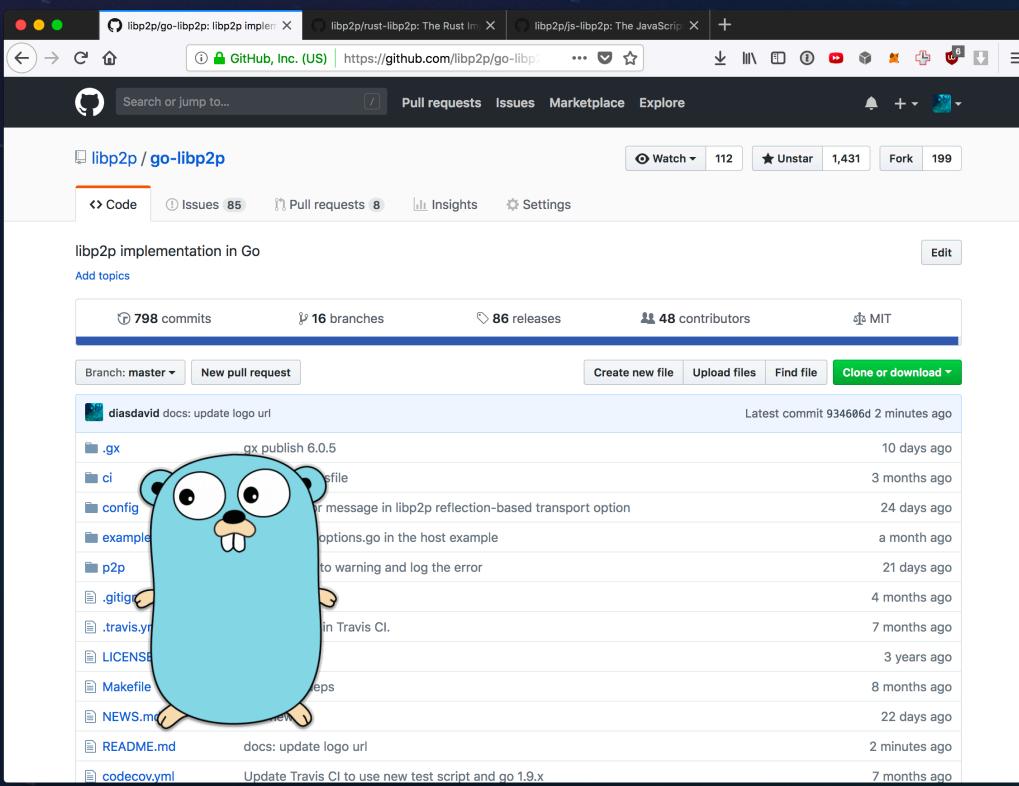
# 7 native implementations (*shipping continuously*)

**js-libp2p**



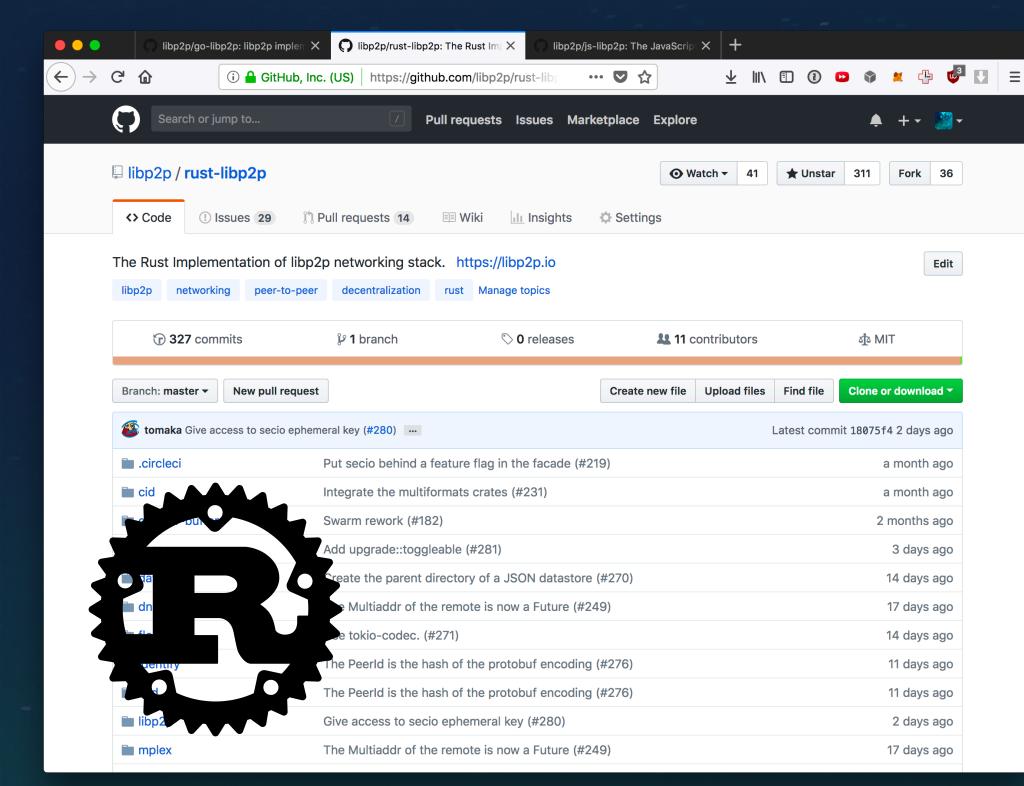
Protocol Labs

**go-libp2p**



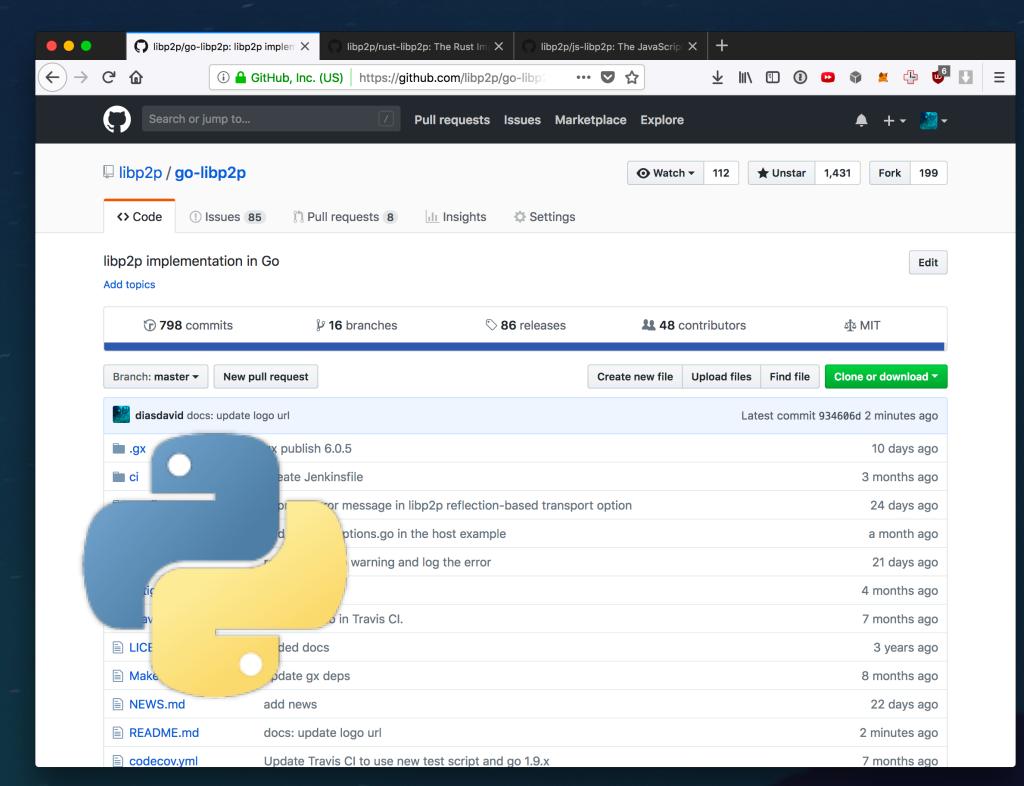
Protocol Labs

**rust-libp2p**



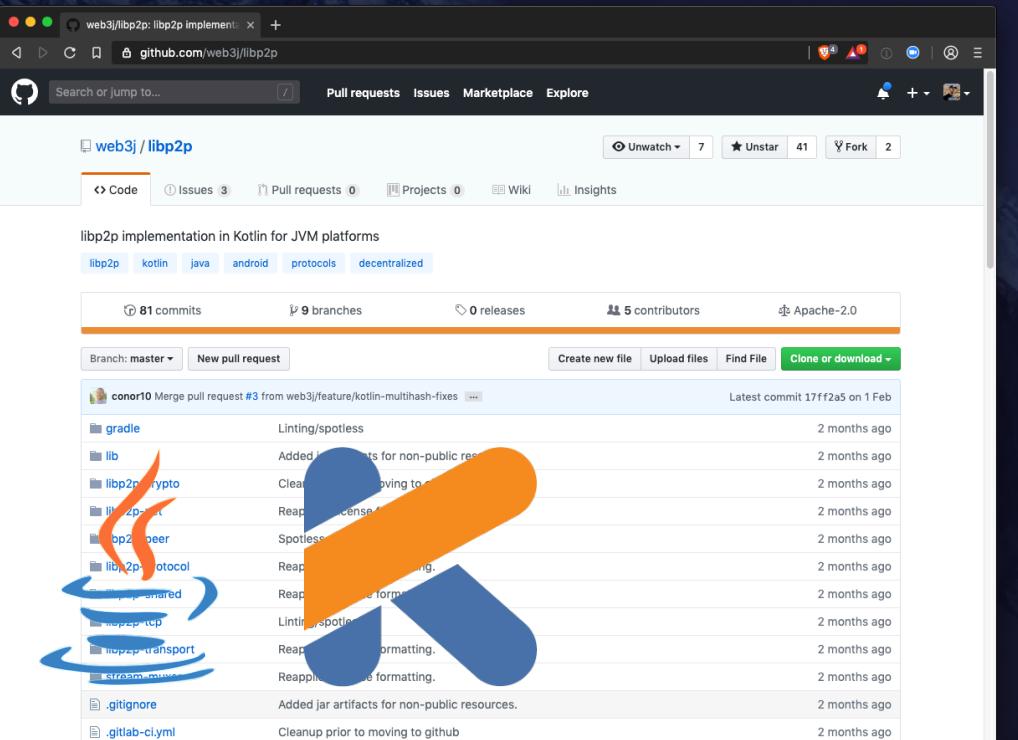
Web3 Foundation

**py-libp2p**



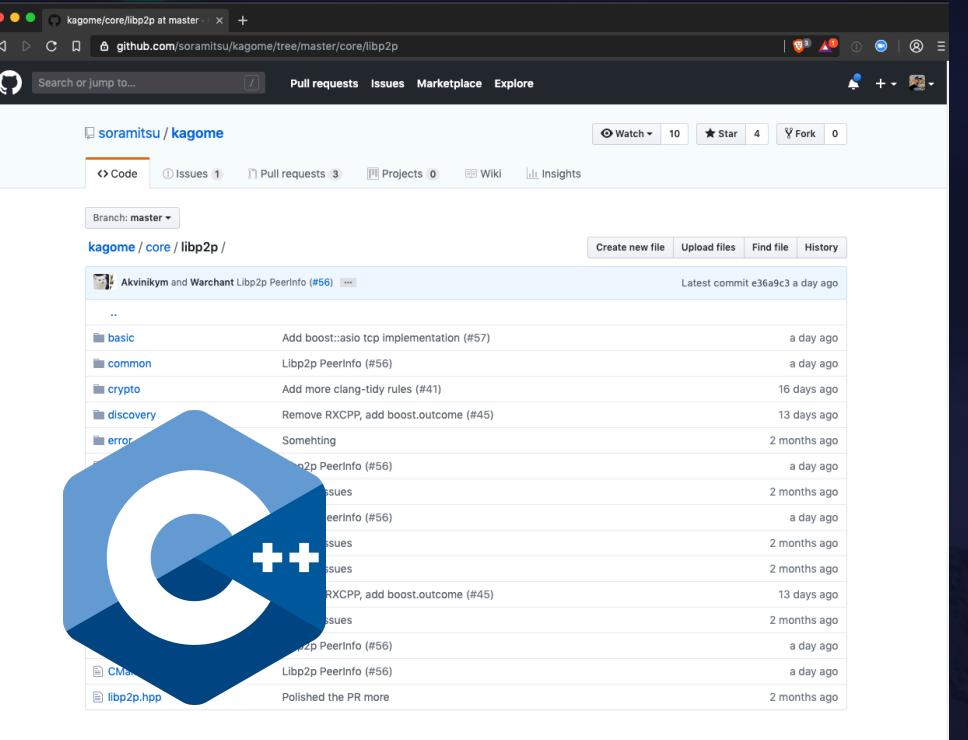
Ethereum Foundation

**jvm-libp2p**



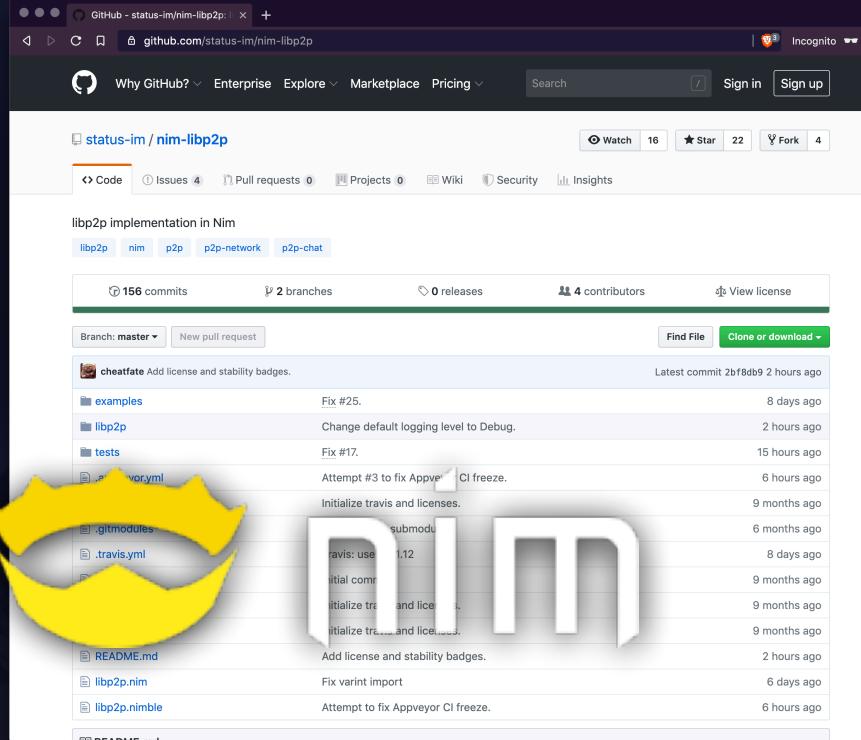
Harmony, PegaSys, Web3 Labs

**cpp-libp2p**



Web3 Foundation, Soramitsu

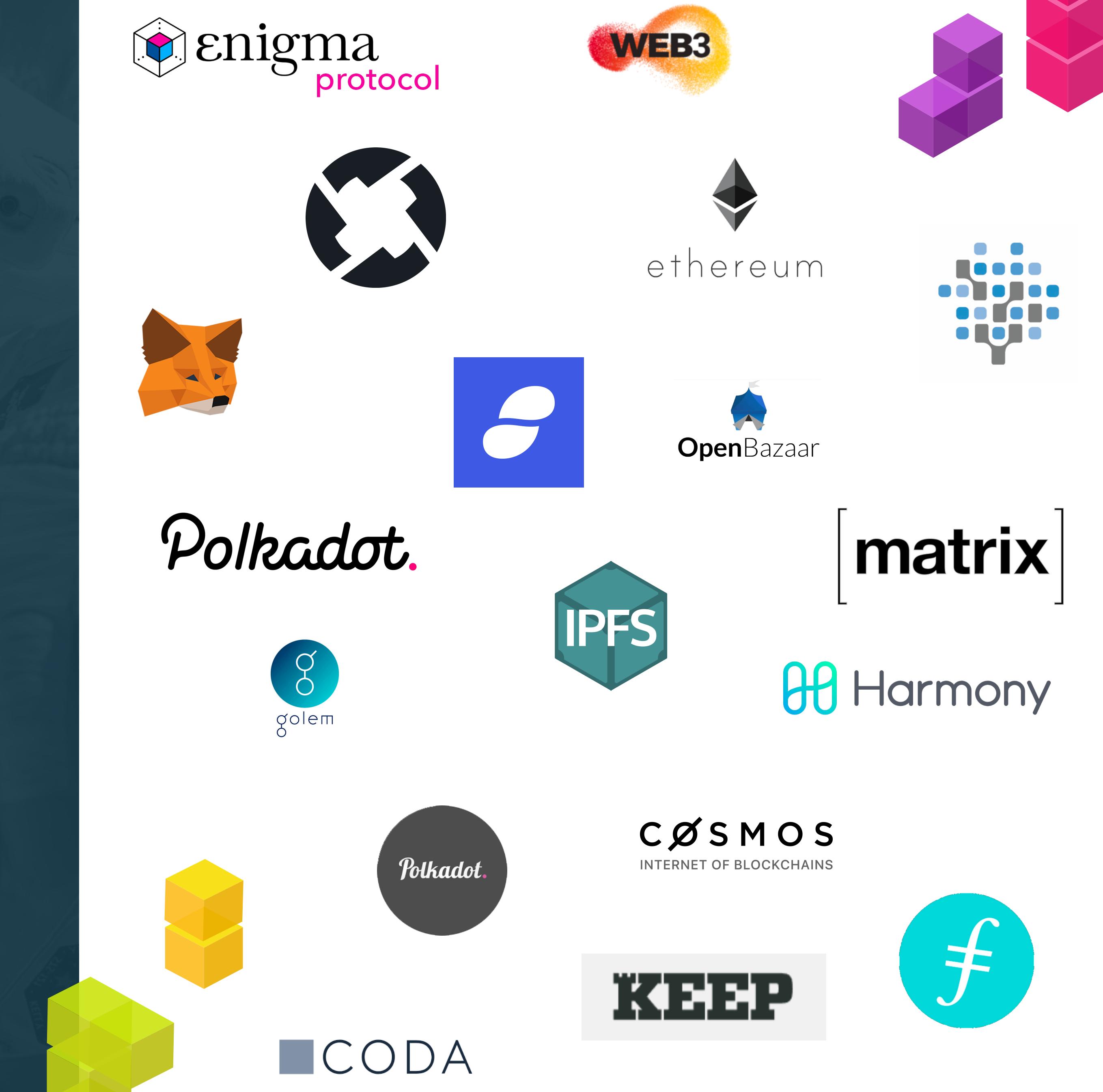
**nim-libp2p**



Status

# ADOPTERS

IPFS  
Polkadot  
Ethereum 2.0  
Filecoin  
MetaMask  
OpenBazaar  
0x  
Golem  
Harmony  
Keep Network  
Validity Labs  
Enigma  
Cosmos (considering)  
Coda Protocol (considering)  
Matrix (experimenting)  
... more



# ETH2 7-WAY INTEROP LIFTOFF



# Ethereum 2.0 networking specification

## Table of contents

- Network fundamentals
    - Transport
    - Encryption and identification
    - Protocol negotiation
    - Multiplexing
  - Eth 2.0 network interaction domains
    - Configuration
    - The gossip domain: gossipsub
    - The Req/Resp domain
    - The discovery domain: discv5
  - Design decision rationale
    - Transport
    - Multiplexing
    - Protocol negotiation
    - Encryption
    - Gossipsub
    - Req/Resp
    - Discovery
    - Compression/Encoding
  - libp2p implementations matrix

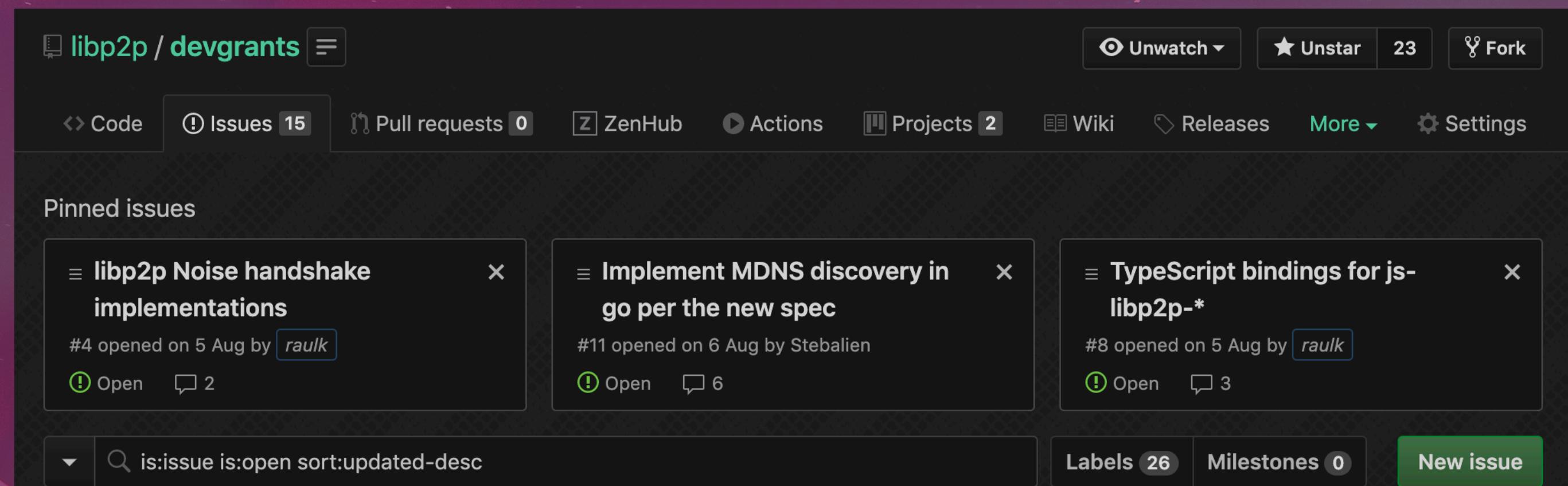


**Jonny Ray**  
@JonnyRhea

**250** Retweets **859** Likes

# LAUNCHED LIBP2P DEVGRANTS @ ETHBERLIN

<https://github.com/libp2p/devgrants>



The screenshot shows the GitHub repository page for libp2p / devgrants. At the top, there are three pinned issues:

- libp2p Noise handshake implementations (#4)
- Implement MDNS discovery in go per the new spec (#11)
- TypeScript bindings for js-libp2p-\* (#8)

Below the pinned issues is a search bar with the query "is:issue is:open sort:updated-desc". To the right of the search bar are buttons for "Labels 26", "Milestones 0", and "New issue".

At the bottom of the page, there is a table with columns for status (checkbox), issue number, title, author, last updated, complexity, kind, language, priority, ready for work, selected, and status. The first few rows are:

	#	Title	Author	Last Updated	Complexity	Kind	Language	Priority	Ready for work	Selected	Status
<input type="checkbox"/>	6	Gossipsub threat analysis	raulk	19 Aug	Hard	Proposal	*	P1	Yes	ETHBerlinZwei	Proposed
<input type="checkbox"/>	7	[PLACEHOLDER] Golang Gossipsub profiling and optimisation	raulk	19 Aug	Hard	Go	Go	P0	Yes	ETHBerlinZwei	Proposed
<input type="checkbox"/>	5	Conformance Test Kit	raulk	17 Aug	Hard	Proposal	Go	P0	Yes	ETHBerlinZwei	Proposed



# BETTER DOCS & SPECS \o/

- [docs.libp2p.io](https://docs.libp2p.io)
- engaged in full specs rewrite
- specs maturity lifecycle
- defining RFC process



The screenshot shows the libp2p documentation website at [docs.libp2p.io](https://docs.libp2p.io). The page title is "PUBLISH/SUBSCRIBE". The main content area contains a diagram illustrating the Publish/Subscribe system. The diagram shows several dots representing peers within a circular area, with arrows pointing from a central point labeled "Topic" to the surrounding "Peers subscribed to topic". Below the diagram, text states: "Publish/Subscribe is a system where peers congregate around topics they are interested in. Peers interested in a topic are said to be subscribed to that topic:". At the bottom of the page, there is a note: "Peers can send messages to topics. Each message gets delivered to all peers subscribed to the topic:".

The screenshot shows the GitHub repository for "libp2p / specs". The repository has 436 commits, 18 branches, 0 releases, and 47 contributors. The repository description is "Technical specifications for the libp2p networking stack libp2p.io". The repository page includes sections for "Manage topics", commit history, and file navigation options like "Create new file", "Find File", and "Clone or download".

Commit	Message	Date
Stebalien Merge pull request #209 from libp2p/rfc/0001-cid-peerid	... Apply review changes	Latest commit 9a63e50 3 days ago
RFC	rename archive dir to _archive	last month
_archive	connections readme: spelling	4 months ago
connections	add @jacobheun to mDNS interest group	3 months ago
discovery	fetch protocol: some document cleanup + consistency	3 months ago
fetch	bubble up and add logo	2 months ago
figs	add header & TOC to identify spec	4 years ago
identify	add header & TOC for mplex spec	4 months ago
mplex	Draft of noise-libp2p spec (#202)	4 months ago
noise	2 months ago	

# LAUNCHED DISCUSSION FORUMS

[discuss.libp2p.io](https://discuss.libp2p.io)

libp2p

all categories Categories Latest Top Bookmarks + New Topic

Category	Topics
Users and Developers	42 2 unread
Implementers and Contributors	36 1 unread
Research and paper discussions	8
News and announcements	8
Ecosystem and Community	9

Latest
D Chat Application using Libp2p: Talking from a peer on MOON with a peer on EARTH using Libp2p 1 9h Users and Developers
N How we discover our own dialable IP address and port 4 6 12h Implementers and Contributors
D STUN ability for Nodes 0 17h
D NAT Traversal with libp2p 0 7d Users and Developers
WILL CUT HORSES Why are streams opened 3 times and close 2 times with 1 connection? 0 12d Users and Developers

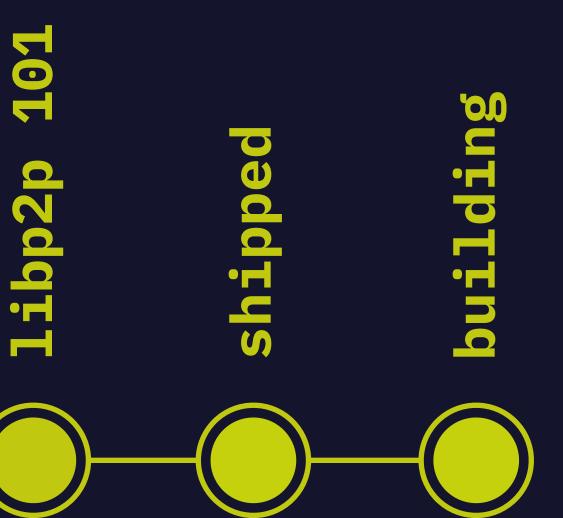
# NEW FEATURES

- AutoNAT and AutoRelay subsystems.
- IPFS AutoRelay experiments and learnings.
- TLS 1.3 spec and implementation in go-libp2p.
- QUIC transport in go-libp2p with draft-23 support.
- WebRTC Direct transport in js-libp2p and go-libp2p (0x, pions).
- Browser-based WASM deployments of rust-libp2p and go-libp2p (0x).
- gossipsub support in rust-libp2p (sigp's fork).
- libp2p daemon.
- refactored interfaces in go-libp2p and adopted go.mod.
- Bluetooth transport in go-libp2p (Berty, to be open sourced), experiments in rust by W3F.
- many stability and performance fixes across the board.



libp2p @ devcon5

BUILDING...



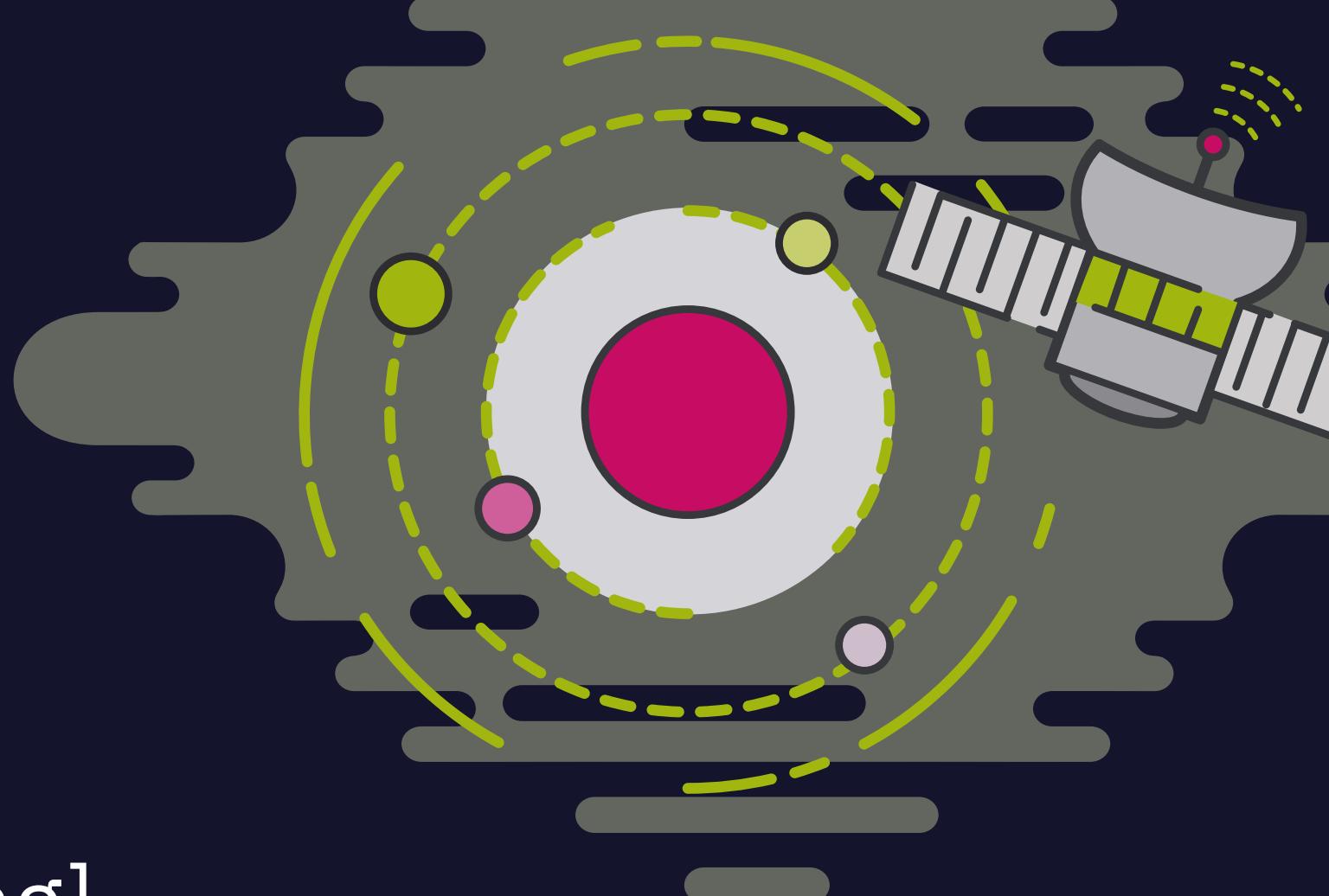
on the horizon

# TESTING AT SCALE



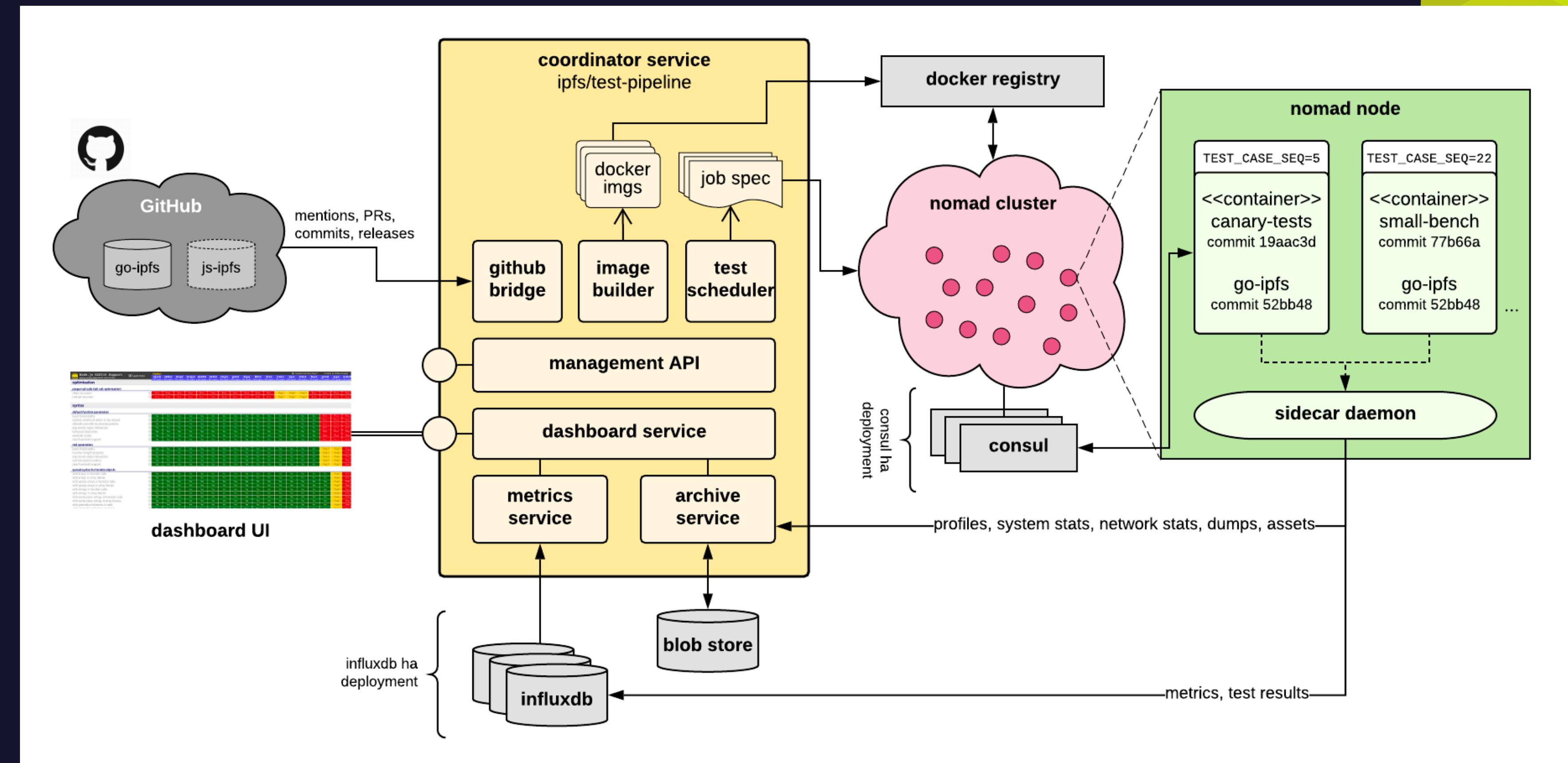
## interplanetary testground

- <https://github.com/ipfs/testground> [status: 🐥 | incubating]
- platform for quantatively and reproducibly measuring the effect of changes across simulated networks (up to 100k).
- tightly integrated with the engineering lifecycle (continuous testing).
- types of testing:
  - comparative testing: how does commit X of project A improve or deterioriate things?
  - scalability testing: self vs. network emergent behaviour/health.
  - chaos testing, interoperability testing, compatibility testing.



expect substantial  
progress in Q4 2019

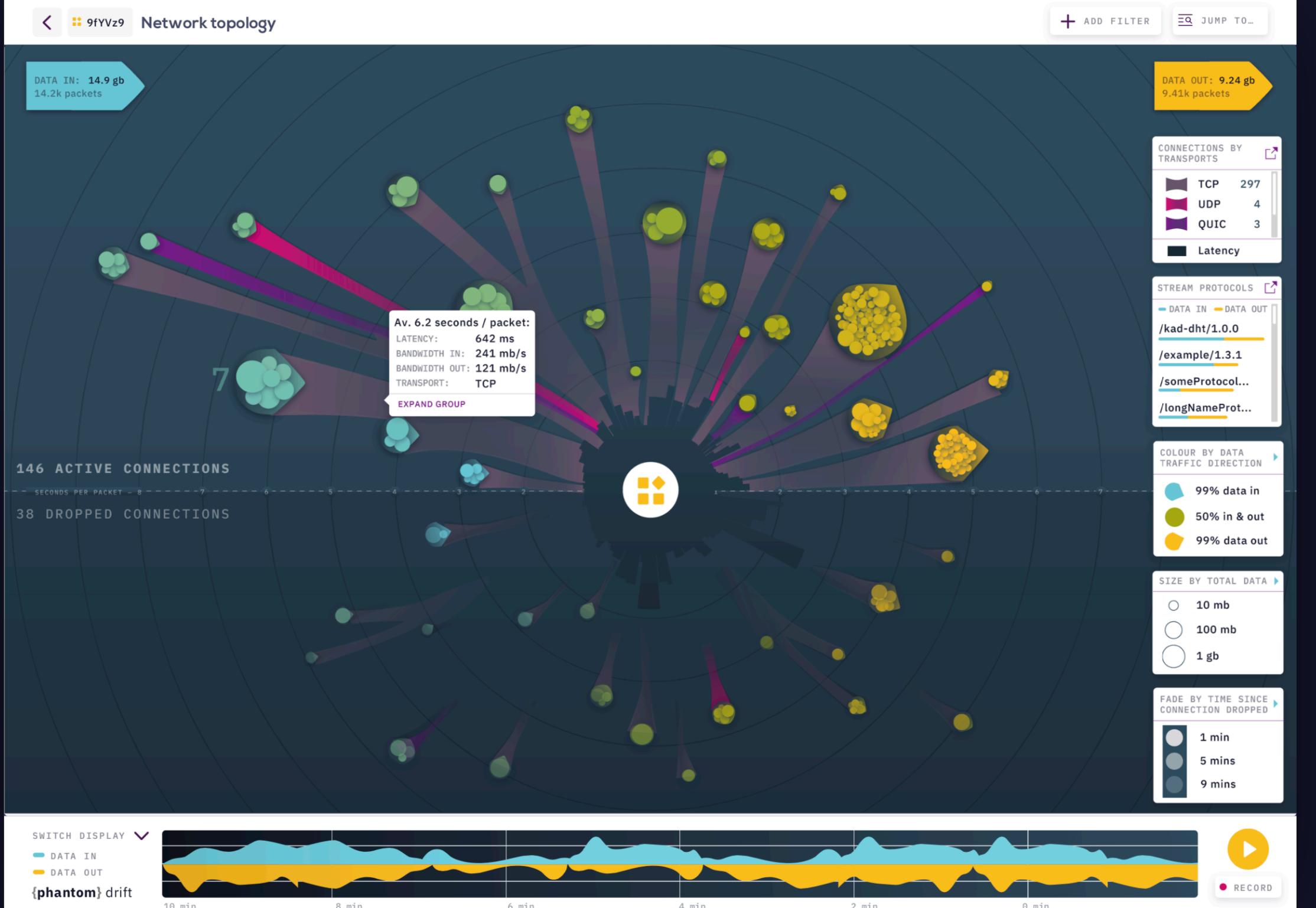
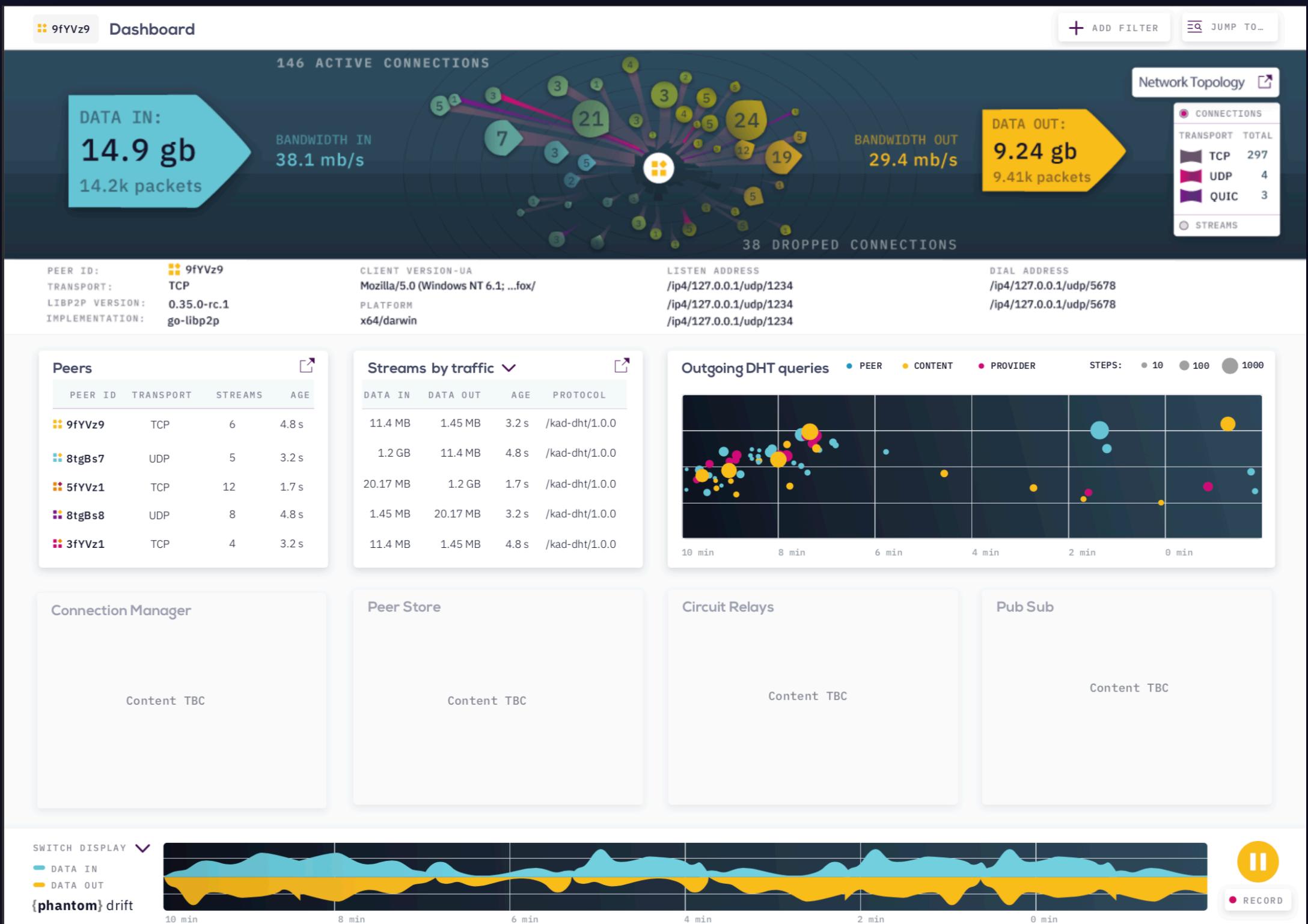
# INTERPLANETARY TESTGROUND



<https://github.com/ipfs/testground>

# on the horizon INSTRUMENTATION

🚀 🔥 standard introspection protocol and d3-powered visualizations.



expect substantial  
progress in Q4 2019

on the horizon

# CONNECTIVITY



## message orientation (UDP).

- libp2p's entrypoint becomes a factory of stacks, from which you then create hosts.
- proof of concept in go-libp2p by the end of Q4 2019. Basis for packet-switched networks.



## NAT hole punching & direct connection upgrade.

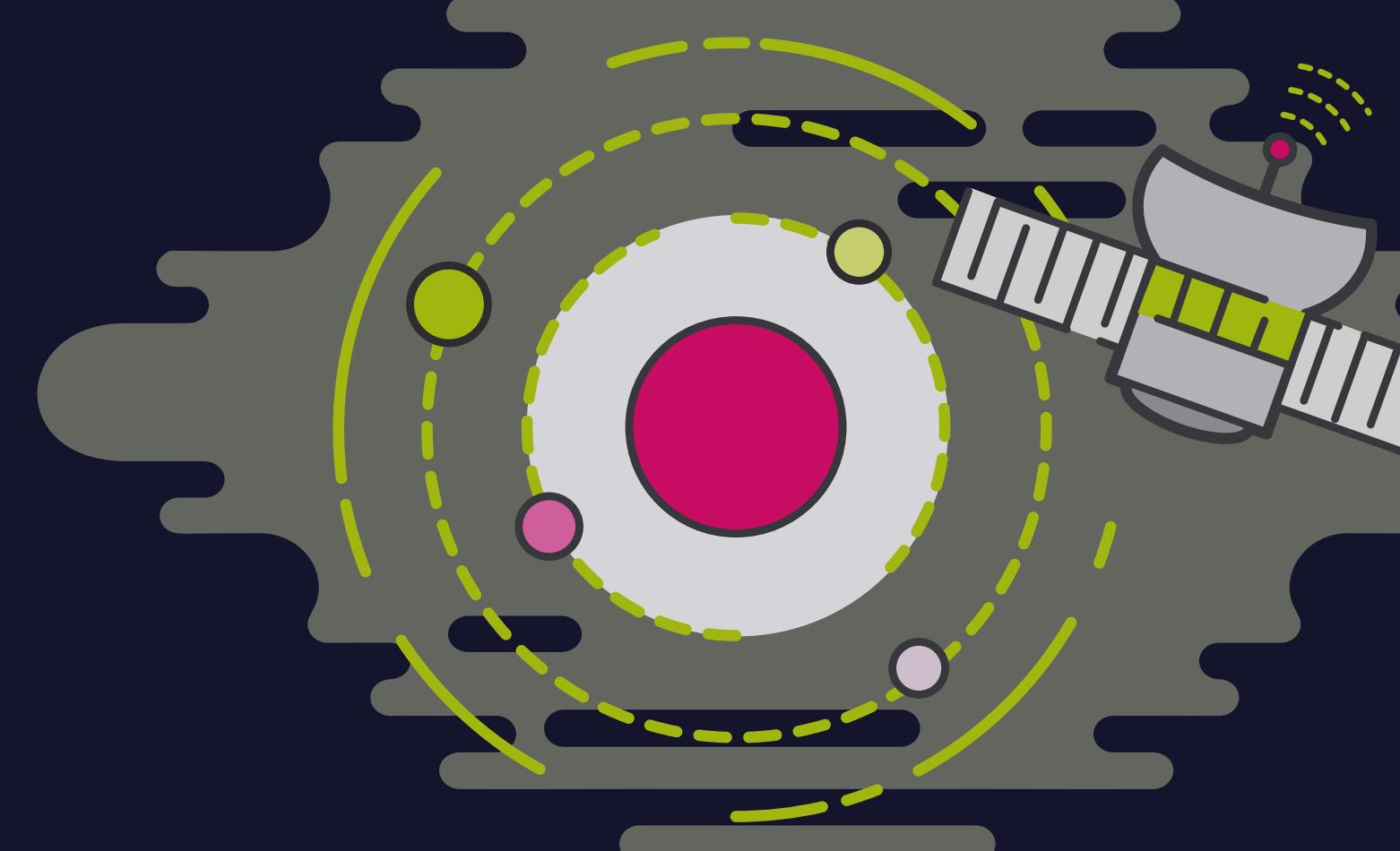
- use relay servers as a conduit for hole punching signalling and sync.
- establish an embryonic relayed connection; immediately try to upgrade to direct conn.
- then transplant connection state (non-trivial).
- TCP success rate is 60%; UDP is 90%. That's also why we want QUIC. Inspired by ICE.



## robust, pervasive QUIC + TLS 1.3 ≡ HTTP/3 (censorship resistance++)

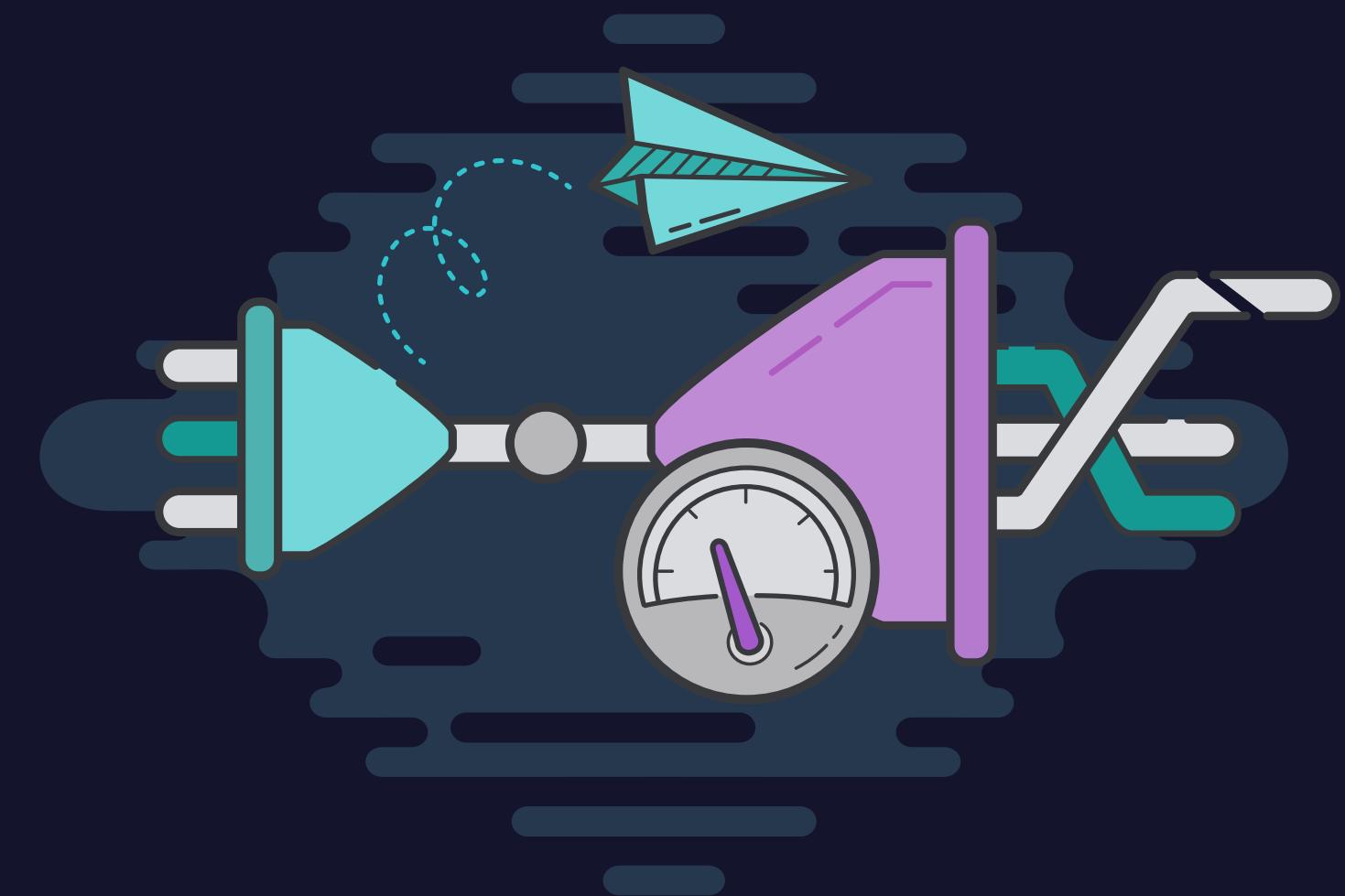


*expect substantial  
progress in Q4 2019*



on the horizon

# NEGOTIATION



## 🚀 📦 multiselect 2.0 for efficient protocol negotiation.

- <https://github.com/libp2p/specs/pull/205>, features:
  - 1-RTT connection bootstrapping.
  - cheap repetitive protocol selection.
  - TCP simultaneous connect support.
  - session resumption.
  - upfront protocol tables.
  - confident selection. interoperable with deterministic or probabilistic discovery-level advertisements, e.g. bloom filters.



*expect substantial  
progress in Q4 2019*

on the horizon

# SECURITY

- 🚀 🎁 new secure channels: **TLS 1.3 & Noise handshakes.**



- **Noise Handshakes.**
  - Noise Pipes: IK for optimistic scenario, falling back to XX.
  - Encrypted early data to expedite multiplexer negotiation.
  - Required by Ethereum 2.0 mainnet.
- **TLS 1.3 in all languages.**
  - Available in go-libp2p. Can enable as an experiment in IPFS.
  - Roadblock in rust-libp2p, **devgrant** available for js-libp2p!

XX:  
-> e  
<- e, ee, s, es  
-> s, se

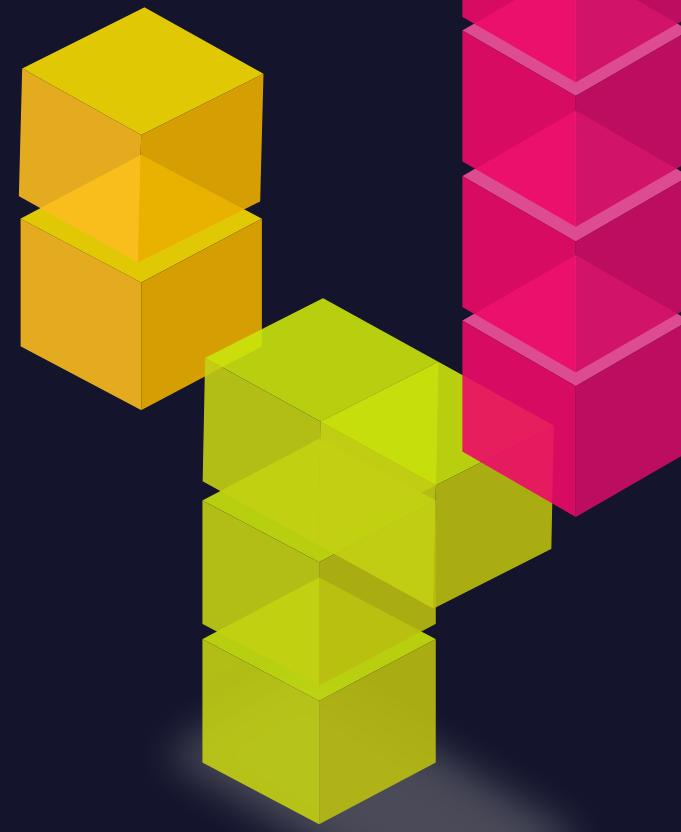
IK:  
<- s  
...  
-> e, es, s, ss  
<- e, ee, se

XXfallback:  
-> e  
...  
<- e, ee, s, es  
-> s, se

expect substantial  
progress in Q4 2019

on the horizon

# EVOLUTION



## language-specific improvements and maturity.

- *js-libp2p*: async/await support, TypeScript declarations (devgrant available!).
- *go-libp2p*: eventbus, service-oriented host (dependency injection), dialer v2.
- *jvm-libp2p*: towards v1.0 for full Android support, and various façade APIs (RxJava, Kotlin coroutines, etc.)
- *nim-libp2p*: specialized in constrained and embedded devices.



## pubsub evolution. *[gossipsub session on Wed @ 14.55 room B10]*



formalisation of gossipsub into academic paper.

- new router >> episub: Plumtree + HyParView + GoCast.



## PM overhaul to boost community alignment and focus.



*expect substantial progress in Q4 2019*

on the horizon

# MORE EVOLUTION



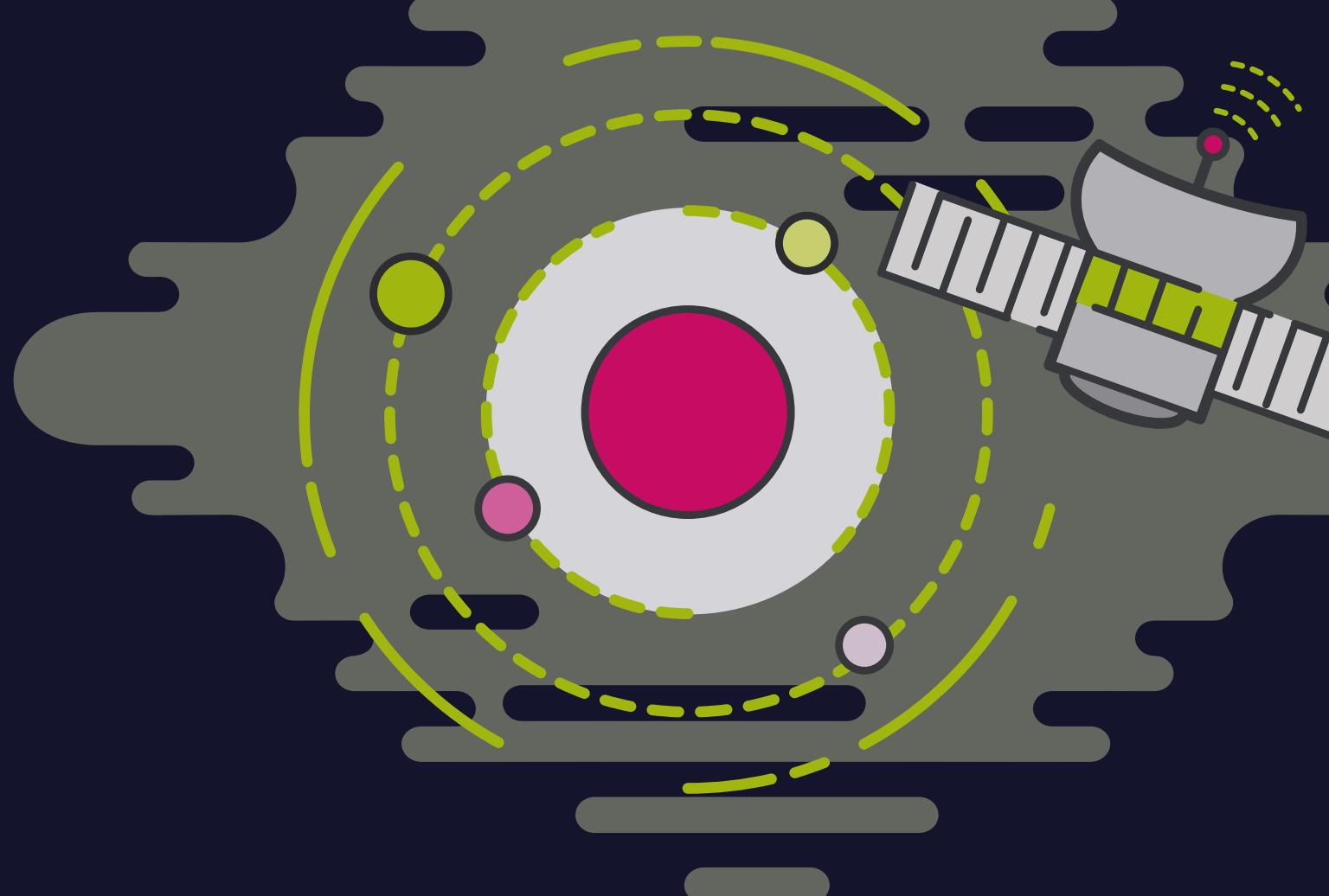
## hardening the DHT => towards DHT 2.0.

- incorporating further elements of Coral, Chord, S/Kademlia, Named Data Networking, etc.
- we have a research team spelunking the state of the art to feed into engineering.
- privacy preserving techniques.
- ***dependent on the testground!***



## even better specs: goal 100% accurately spec'ed.

- **other topics:** CTK (conformance test kit), onion routing / mixnet integration, reputation management, traffic shaping, abuse prevention, decentralized telemetry, self-healing networks, etc.

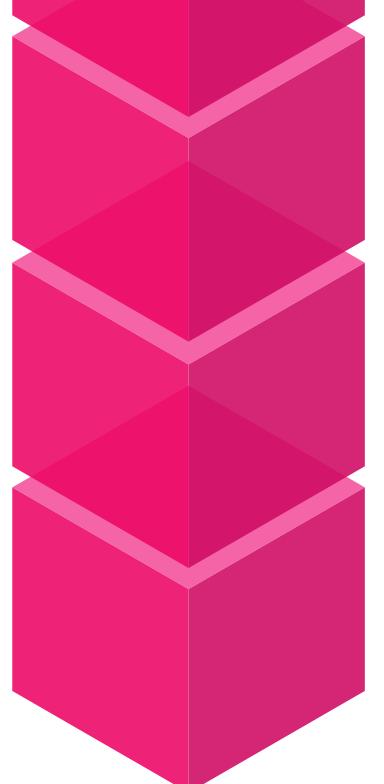


*expect substantial  
progress in Q4 2019*

# SHOWCASE: BLUETOOTH

in go-libp2p running within iOS

Connection established



*WE*



*YOU*

next session: Wed @ 14.55 room B10 -- gossipsub

**get involved through GitHub!**

shape the future

hack on meaty things

contribute



[libp2p/specs](#)



[libp2p/devgrants](#)



project repos



libp2p

wanna chat?

**LET'S HACK ON THE  
FUTURE OF P2P  
NETWORKING TOGETHER.**

---

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