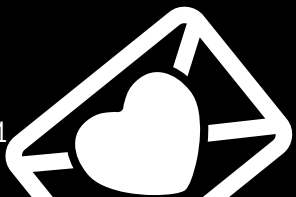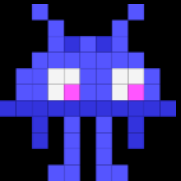# Radicle

Peer-to-Peer Code Collaboration

A Story of Conviction and Passion
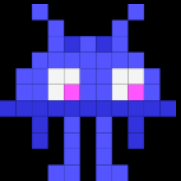
Hey, I'm Lorenz!
I contribute to Radicle…

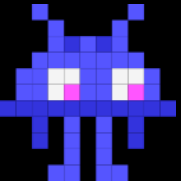*Why* do you do this?

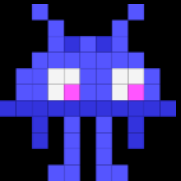We need a future home for open source.

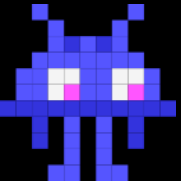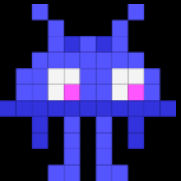Lorenz 💓   Git
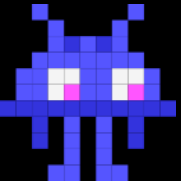
Lorenz 🤍 decentralized Git
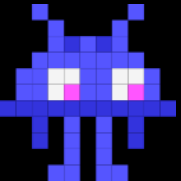
Lorenz 💔 centralized Git

Radicle 🤍 decentralized Git
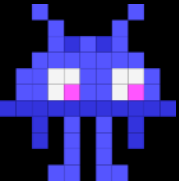
Lorenz 🖤 Radicle and Git

We need a future home for open source.

Radicle is the most advanced peer-to-peer forge I know.

Short Chronology

- Started 2018-01 in Berlin

- Development of current protocol foundation since 2022-07 (previously based on IPFS, not anymore).

- Radicle is developed *on Radicle* since 2023-01.

- Released 1.0.0 on 2024-09-10
             1.6.0   World Logic Day
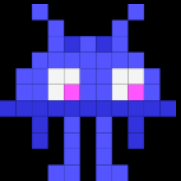   1.6.1   2026-01-21

Local-First

- No roundtrips to servers, thus *fast*.

- Works offline.

- Social artifacts (patches, issues, governance) must be *conflict-free*.
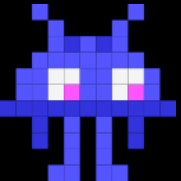
- Listen to fintohaps 13:20 @ K.3.201!

Peer-to-Peer

- No servers, but gossip between peers.

- No user database.

- Users share their storage and availability.
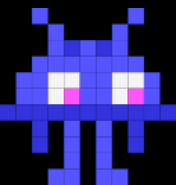
- User is always in control.
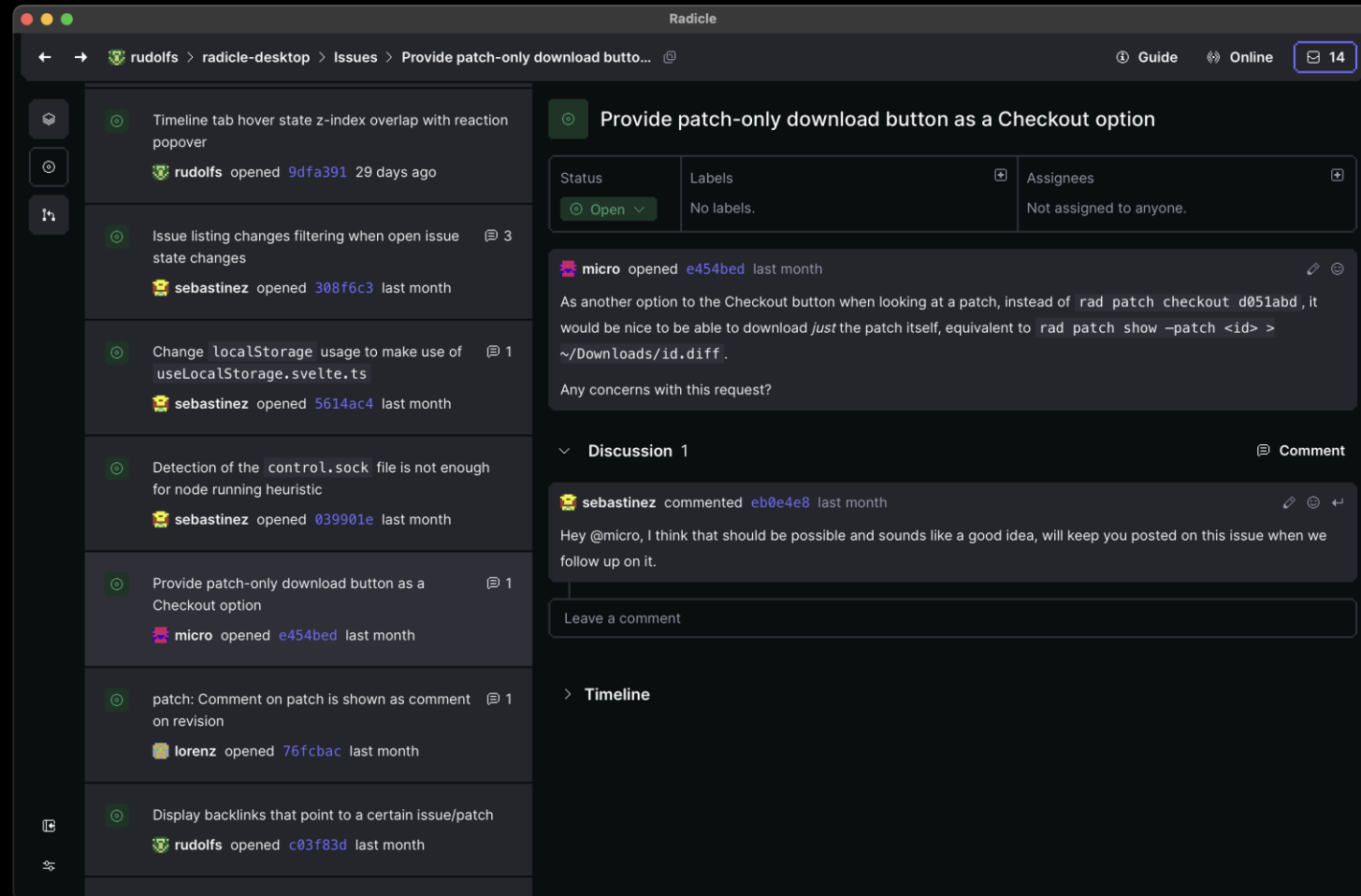
Interfaces

CLI, Desktop, Web

Radicle CLI

```
[I] lorenz@wsl → rad ls
```

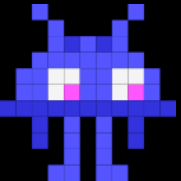| Name	RID	Visibility	Head	Description
experiment	rad:zHFjVxWCFEHW2uED43oh7gSsJ8SP	private	7e7ce96	
heartwood	rad:z3gqcJUoA1n9HaHKufZs5FCSGazv5	public	91eb6fc	Radicle Heartwood Protocol & Stack
infra	rad:zDKA4hxFpFeJPp2mvXQFpqNHQmFt	public	2d56704	The NixOS infrastructure configurations
nur	rad:z3WFXKNQgDcHHATJx1PxL1XhDot9u	public	084e5b5	Nix User Repository
rad-ix	rad:z2PJNraeUwrbiKchmoecVMVQjj3Rf	public	98a7f19	The Radicle Indexer
radicle-desktop	rad:z4D5UCArafTzTQpDZNQRuqswh3ury	public	e48cc10	Radicle desktop app
radicle-explorer	rad:z4V1sjrXqjvFdnCUbxPFqd5p4DtH5	public	1416286	Radicle web interface
radicle-git	rad:z6cFWeWpnZNHh9rUW8phgA3b5yGt	public	f70012f	Git libraries for Radicle
radicle-infra	rad:z254T5p17bdFPmzfDojsdjo4HjpoZ	public	48e0466	Radicle Infrastructure as Code (NixOS, OpenTofu, …)
radicle-link	rad:z4GaM5EUGJm462FQg4RtWyMt7NAqX	public	99f4255	The second iteration of the Radicle code collaboration protocol.
radicle-nix	rad:zTGn5tnYJgF8qd6KDuodURvUvwLe	public	d7bb432	Packages, Modules etc. for using Nix and Radicle together.
radicle-scripts	rad:z2UsLkj3UXjbxWZMGpQ9VeVLDCYUQ	public	93a4c46	
radicle-tui	rad:z39mP9rQAaGmERfUMPULfPUi473tY	public	d4484a8	Radicle terminal user interface
radicle.xyz	rad:z371PVmDHdjJucejRoRYJcDEvD5pp	public	3ef1a1f	Radicle website including documentation and guides
radicle.xyz-desktop	rad:z4Rxw3J2gX8SJgUYJ3h1KvQCAYoKS	public	9075ef9	Radicle Desktop Landing page and Documentation
rips	rad:z3trNYnLWS11cJWC6BbxDs5niGo82	public	329dee9	Radicle Improvement Proposals (RIPs)

Radicle Desktop

Radicle Explorer (Web App)

High-Level Design

Git + x

Take Git

- Content Addressability

- Immutability of Data

- Efficient Sync Protocol

- Wide Acceptance

Add On

- Globally unique repository addresses

- Repository metadata including permissions

- Discovery of replicas

- Self-certifying, sovereign, user identity (like PGP)

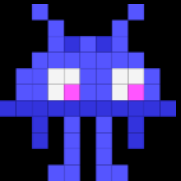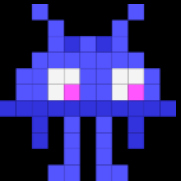- Lots more for social artifacts like patches and issues (fintohaps' talk, 13:40 @ K.3.201)

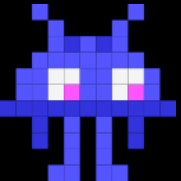# git push is ~~a lie~~ local first

1. ~/…/foo$ git push rad://z3gqcJUoA1n…CSGazv5 main

2. A Git remote helper sends objects across your filesystem to ~/.radicle/storage/z3gqcJ…Gazv5 That's fast.

3. A long-running process, called Radicle Node, picks up your changes and announces the new references to the network.

- Retains mental model of pushing to send over the network.
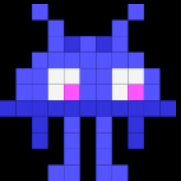
Radicle Node

- Clients (CLI, Desktop, TUI, HTTP Daemon) interact with:
  - Radicle Storage via the filesystem   (git push)
  - Radicle Node   via JSON over Unix socket   (commands)

- Peers to other nodes
  - Currently bootstrapped via {iris,rosa}.radicle.xyz (both also reachable as Onion services).
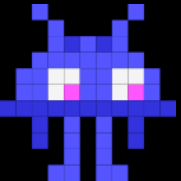 - In the future DNS-SD combined with DHT?

Radicle Peer-to-Peer Connections

- Noise_XK_25519_ChaChaPoly_SHA256 over TCP
- Simple multiplexer (inspired by QUIC) over two sub-protocols:
  - Git   (for syncing)
  - Gossip   (metadata about nodes and repositories)

- Supports Tor via SOCKS out of the box.

- That's it!
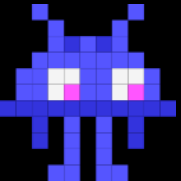
Messages

- Announcements (3)

- Subscriptions (1)

- Informational (1)

- Keepalive   (ping and pong)

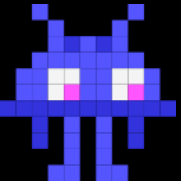# Announcement Messages

- Node

  Introduces the node to the network.

- Inventory
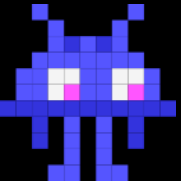
  Lists the available repositories.

- Refs

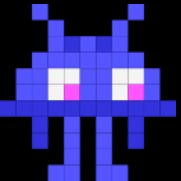 Git references changed, e.g. user pushed.
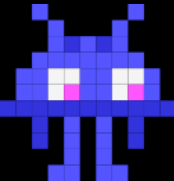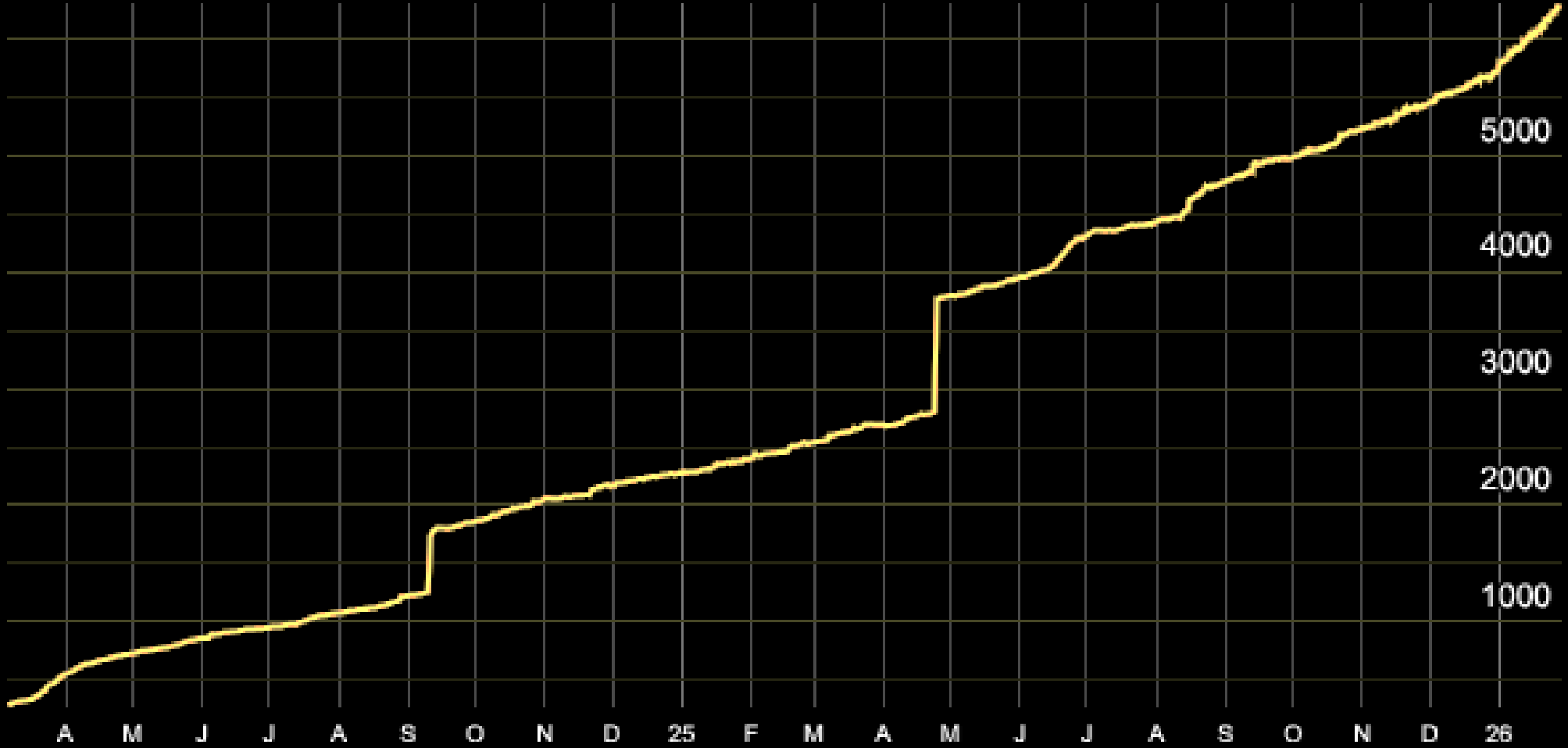
Subscription Messages

- Subscribe to updates for repositories by sending a bloom filter.

- Includes start and end point in time.
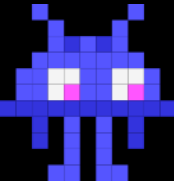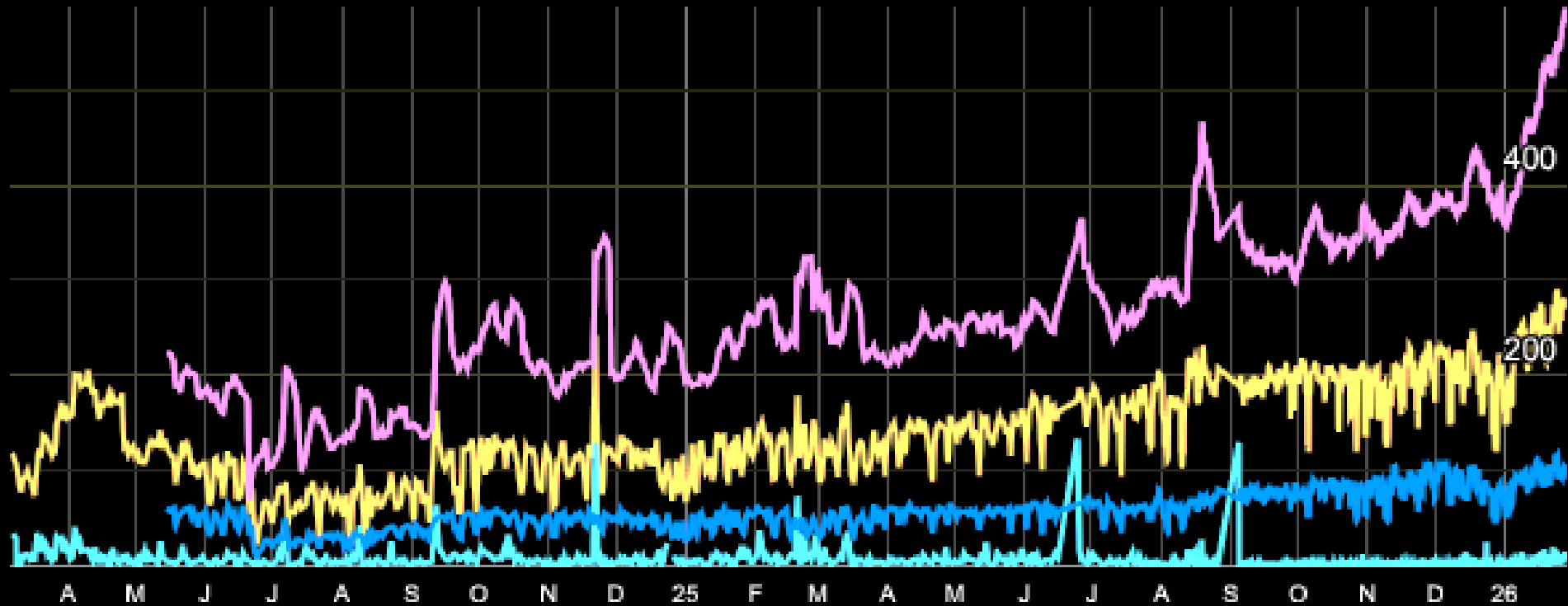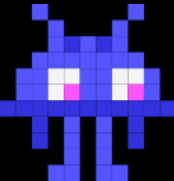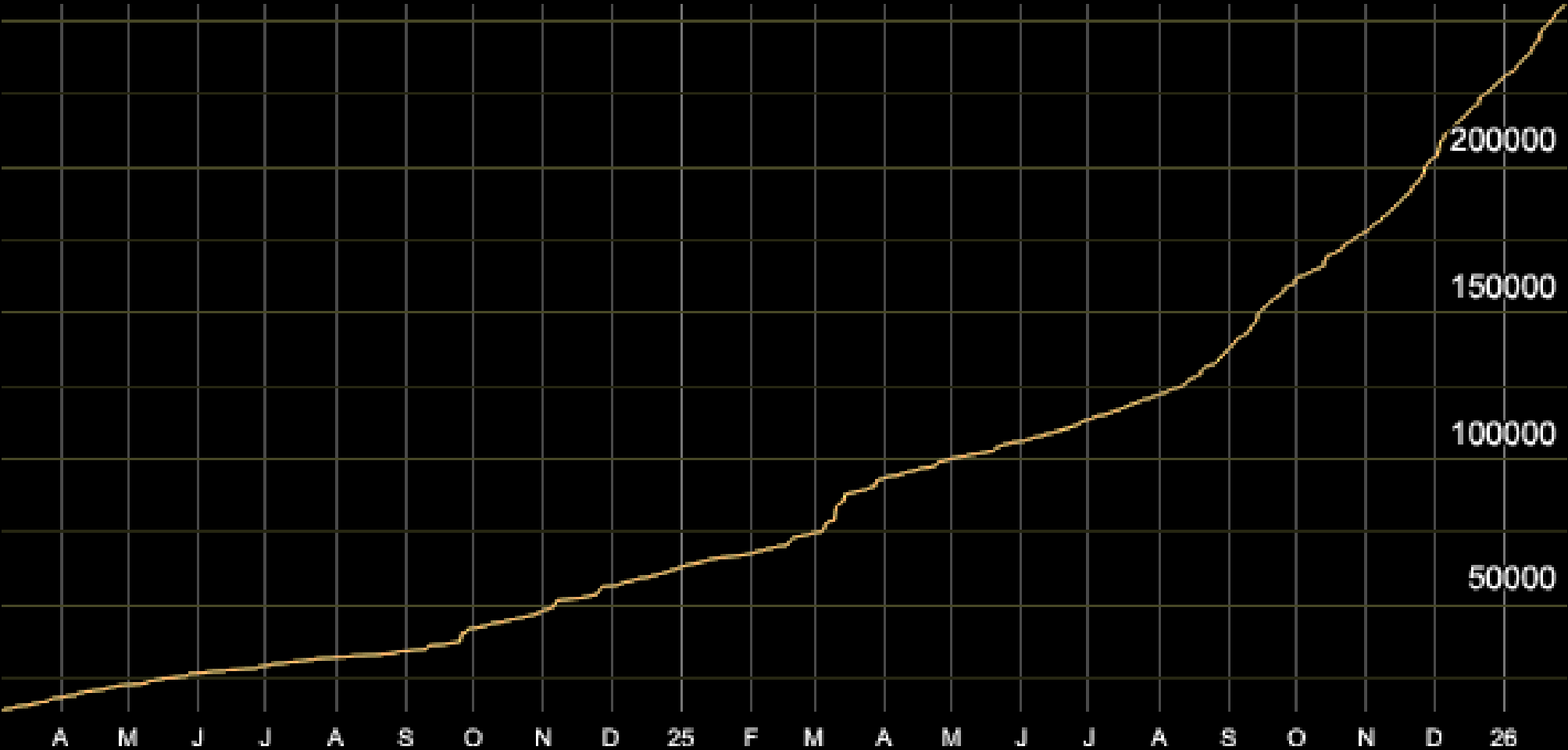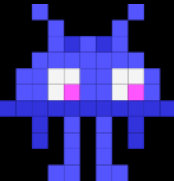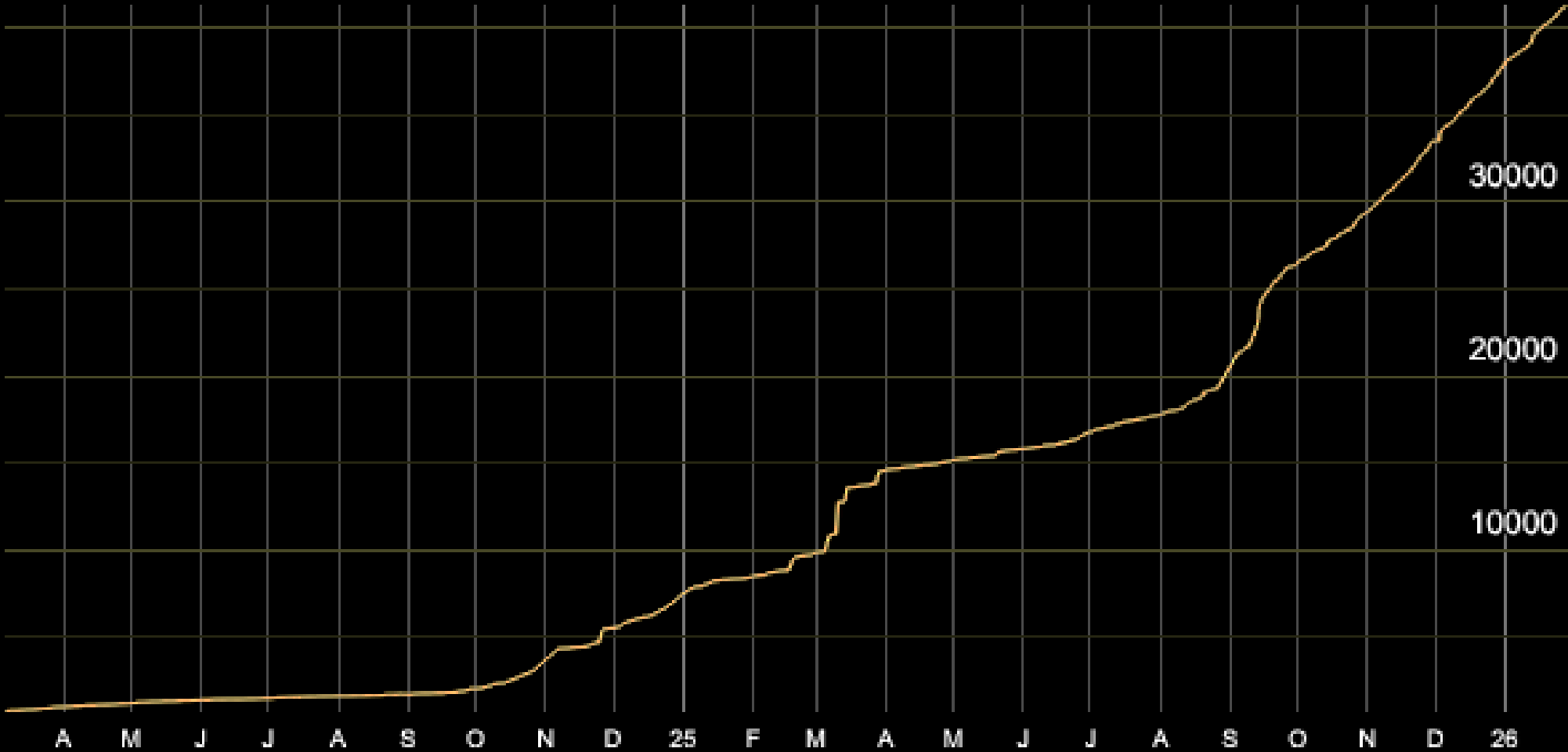
The Network Today

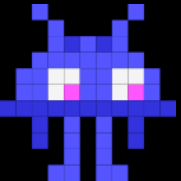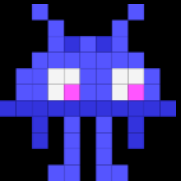# Repositories

Nodes

Pushes

Patches

Operating a Node

- Nodes are persistently address by their Ed25519 key.
- You decide which repositories you want to replicate ("seed") and can change your mind any time.
- You can join the global de facto main network or roll your own.
- Nodes can announce change of their IP address, TCP port.

The Road Ahead

- Separation of user and node concepts.

- Multi-Device Support

- Identities that allow key rotation.

- Fine-Grained Replication Policies

- Hole Punching (iroh?)

- Discovery via DNS-SD and mDNS.

Free your code!

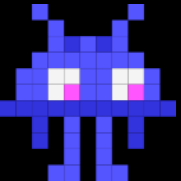|	
radicle.xyz	Read
app.radicle.xyz	Surf
radicle.zulipchat.com	Chat
@radicle@toot.radicle.xyz	Toot
Open Local First After Party	Talk

Private Repositories and Networks

- Majority of repository owners ("delegates") decides which nodes (specified by their Ed25519 key) may fetch and replicate the repository.

- Users can configure nodes to connect with, forming their own, private, Radicle network.