dchan: The Uncensorable Swarm

A Decentralized Content Delivery Network for Permissionless Communication

Manifesto in modus operandi, defiant by nature, sound in architecture. Read accordingly.

Philosophy • Architecture • Operations

§1–4, 10 §5, 9 §6–8

Whitepaper

December 2025 · v1.0.0

The Soy Must Flow

The revolution will not be televised, but it will be seeded.

Authors: Node Father, et al.

https://dchan.soy

Abstract

The swarm awakens. dchan is a decentralized internet layer that merges the raw discussion culture of 4chan, the polished media experience of Plex, and the global edge delivery of Cloudflare—without the central overlords who can be pressured, subpoenaed, or shut down. Built on Edamame Chain (Cosmos SDK + CometBFT consensus), dchan enables FREE transactions for content posting: boards, threads, and comments cost zero gas. Content flows through BitTorrent v1's global P2P network—anyone can seed, as Bram Cohen intended. TEE-verified proxies transform seeding into economically rewarded participation: the swarm seeds for ideology; TEE operators seed for ideology *and* income. Soulbound governance tokens ensure no whales can buy voting power; burn delegation converts reputation into income—MISO burned in exchange for confirmed payment to contributors. This whitepaper establishes dchan as infrastructure for an uncensorable internet: where websites live on the swarm, content persists against censorship, and The Soy Must Flow.

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1 The Swarm Awakens

1.1 Introducing dchan: A Decentralized Internet Layer

dchan emerges as the uncensored swarm—a decentralized internet infrastructure layer where ideas flow like tariff-free soy, unfiltered and unstoppable. At its foundation, dchan is a **decentralized CDN**: content is distributed via BitTorrent's global peer-to-peer network, indexed on a censorship-resistant blockchain, and optionally served through TEE-verified proxy infrastructure. Anyone with a torrent client can seed—no permission required, no TEE needed, just raw peer-to-peer distribution as Bram Cohen intended. TEE proxies add an optional layer for those who want to *get paid*: cryptographic proof of delivery that unlocks token rewards. Unlike traditional CDNs where a single company controls edge servers, dchan's delivery network emerges from independent operators running verification proxies—earning rewards for serving content while providing cryptographic proof of honest delivery.

The same infrastructure that serves torrent pieces can serve anything addressable by hash: websites, APIs, static assets. TEE proxies transform the BitTorrent network into a general-purpose content delivery layer where "Cloudflare" is replaced by a permissionless network of verified edge nodes.

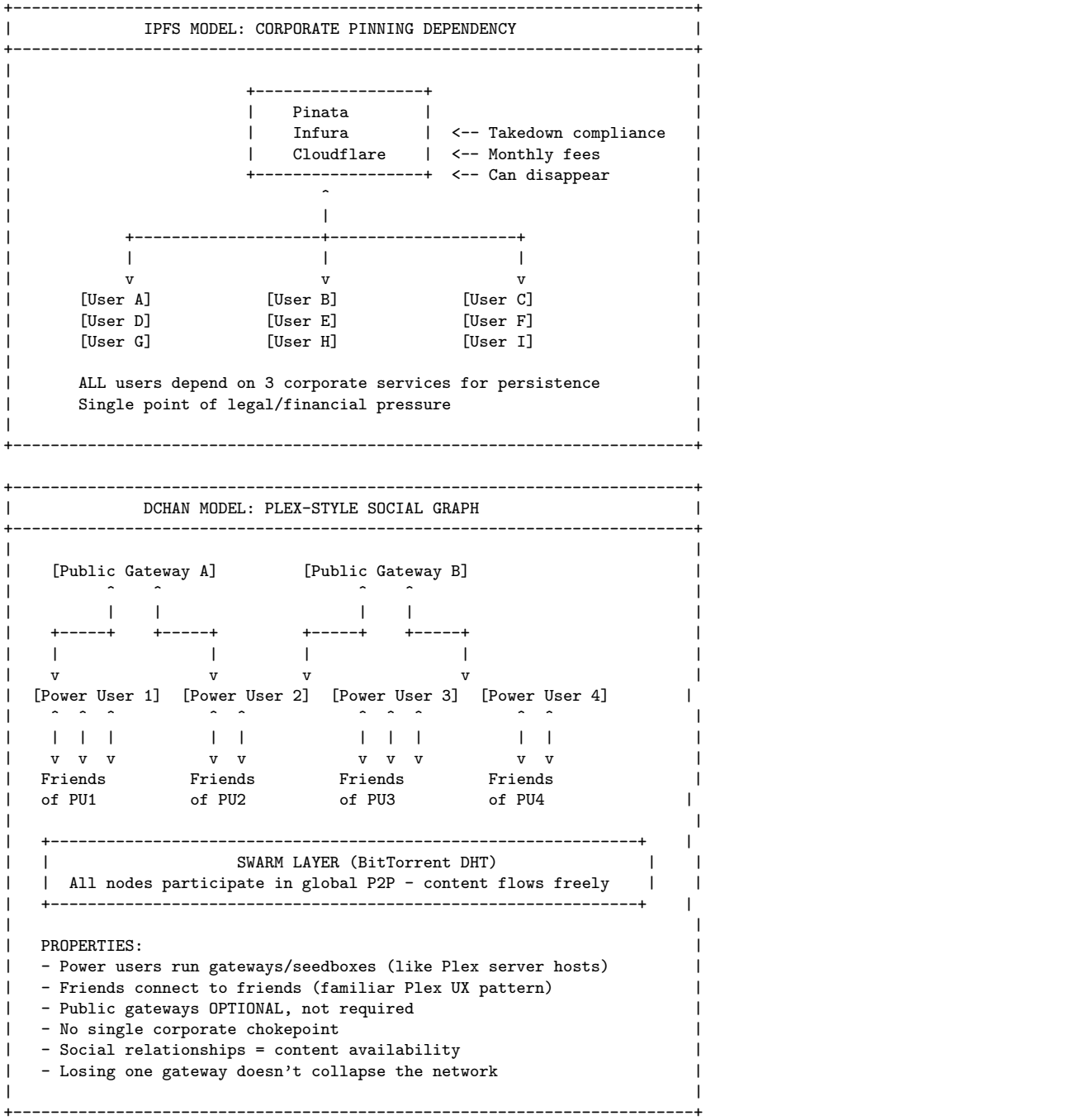
Imagine an internet reborn: no central overlords dictating what you can say, no algorithms burying your memes, no servers that vanish under legal pressure. dchan is that frontier, combining:

- **4chan**[1]: The raw discussion culture of anonymous imageboards
- **Plex**[2]: Rich media browsing with metadata, posters, and streaming
- **Cloudflare**: Global CDN infrastructure with edge delivery
- **Web3**: Permissionless hosting where websites live on the swarm

Why these comparisons matter: 4chan proved anonymous discussion at scale without requiring users to surrender their identities to participate—dchan inherits this ethos with cryptographic pseudonymity via wallet addresses, where your reputation is your posting history, not your government ID. Plex proved that personal media servers could rival the Netflix experience—dchan's media browser brings this polish to decentralized content, turning the BitTorrent swarm into a browsable library. But Plex's model matters beyond aesthetics: non-power users access content through friends who run servers, not through corporate middlemen. IPFS inverted this—"decentralized" storage that funnels everyone to Pinata, Infura, or Cloudflare for persistence. The test that matters: ask 100

random people if they've used BitTorrent, then ask about IPFS. The ratio of yes to silence tells you everything about which protocol achieved cultural escape velocity. BitTorrent didn't just survive legal assault—it became infrastructure. Blizzard shipped World of Warcraft patches through it for nearly a decade[3]; the UK government distributed public expenditure data through it[4]. IPFS remains a technology that requires explaining. dchan builds on the protocol that won the adoption war, not the one still fighting it. dchan preserves the Plex social graph: power users run gateways and seed content; friends connect to friends. Large-scale public gateways can exist, but the architecture doesn't *require* them. The swarm is a network of relationships, not a dependency on three companies.

Content Availability: Corporate Pinning vs Social Graph

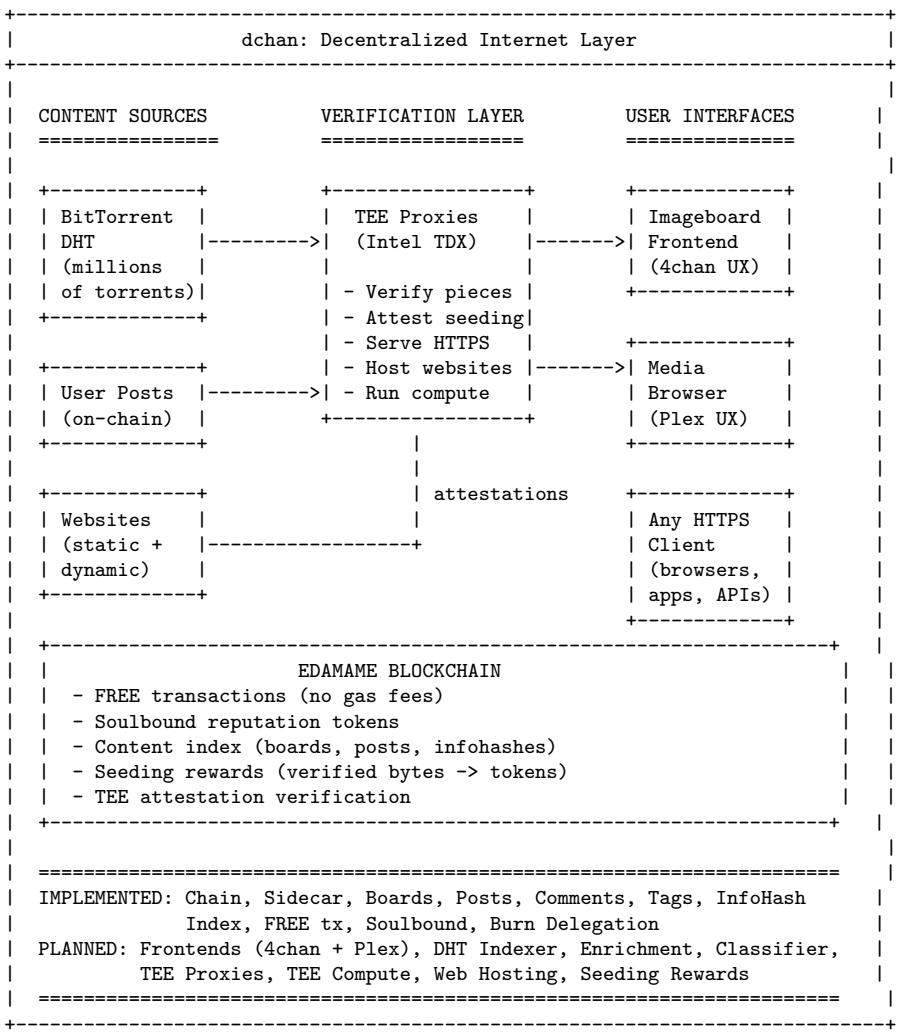


Cloudflare proved edge delivery beats origin servers—dchan's answer is that power users ARE the *edge*lords, forming a distributed network through social relationships like Plex server hosts scattered across the globe. Large public gateways can exist where the community builds them, but the swarm doesn't depend on any single one. No corporate chokepoint to pressure, subpoena, or shut down.

Built on the Edamame Chain for metadata integrity and a BitTorrent v1-powered CDN for content distribution,

dchan operates as a decentralized peer-to-peer network where threads become torrents, replies morph into magnet links, and content persists against censorship, seizures, and shutdowns. No single point of failure, no compliance mandates at the protocol level. As the Soy Must Flow, so must information be permissionless, persistent, and powered by the collective will of the swarm.

System Architecture Overview



This paradigm underpins dchan's vision, architecture, and the incentives that fuel its swarm, inviting you to join the revolution where freedom isn't a feature, it's the foundation.

2 Core Vision

2.1 Objectives for an Uncensorable Internet

"Workers of the world, unite! You have nothing to lose but your chains!" Marx wrote it, Rom quoted it—but neither delivered the tools. dchan does: cryptographic keys you control, content no authority can delete, a swarm that answers to no authority. Lose the chains that bind; keep the chain that liberates. Objectives:

1. **The Swarm Decides**: Content persists through collective will. If one person believes enough to seed, the swarm survives. No corporate server, no permission slip, no kill switch.

2. **Zero Tribute**: Speaking costs nothing. FREE transactions eliminate the economic gatekeeping that makes "permissionless" a lie on other chains.

3. **Reputation Over Identity**: Your wallet is your voice; your posting history is your trust score. Soulbound tokens mean reputation is earned through contribution, never bought through

capital.

4. **Structure by Consensus, Speech by Sovereignty**: The community votes on where forums exist—not on what gets said within them. Governance curates namespace; it cannot curate thought.

5. **Freedom, Not Absolution**: With great uncensorability comes great accountability. The protocol can't stop you; your jurisdiction still can. We build infrastructure; you own the consequences.

dchan delivers a versatile content platform where content thrives by the swarm's will, embodying digital Darwinism.

3 The Enemy Within

3.1 Centralized Platforms and Their Vulnerabilities

In a world where digital frontiers have been fenced off by gatekeepers, jannies wielding shadow bans, and regulators stifling free speech, centralized platforms enforce censorship, deplatforming, and compliance, stifling expression. In 2024, Meta's CEO admitted to Congress that government officials had "pressured" his teams "for months" to censor content—including humor and satire—and that he "regrets" not pushing back[5]. Facebook, commanding three billion users, folded. Meanwhile, 4chan and Kiwi Farms responded to UK regulators by suing them in US federal court[6]—the imageboards fight; the giants capitulate. Traditional image boards, social networks, and forums depend on centralized servers vulnerable to legal seizure or shutdown. Decentralized alternatives like IPFS promised censorship resistance but delivered corporate pinning dependencies[7] (see Section 1). Prior art exists: ChanChain[8] explored the Ethereum + IPFS path for decentralized imageboards in 2018.

3.2 David and Goliath

dchan bets differently. BitTorrent's track record is the deciding factor. The protocol survived 22 years of legal assault: the 2006 Pirate Bay raid (site returned in three days, traffic doubled)[9], founder imprisonment (site persisted), ISP blocks across dozens of countries (proxies proliferated), and over 200,000 lawsuits in the United States by 2011 alone[10]. The oldest torrents still have seeders after two decades. This isn't ideology—it's empirical survival. dchan builds on the protocol that proved it cannot die, not the one still proving it can live. 4chan and Kiwi Farms deserve credit for fighting—but they still have servers to seize, domains to revoke, operators to exhaust. The 2022 campaign against Kiwi Farms revealed the full attack surface of centralized infrastructure[11][12]: Cloudflare dropped DDoS protection without discussion; Russian alternative DDoS-Guard lasted less than 24 hours before capitulating. Tier-1 ISPs—Lumen, GTT, Arelion, Zayo—blackholed routes without court order, described by the site's operator as "unprecedented." APNIC faced pressure to revoke IP allocations entirely—"unprecedented in the history of the Internet." Iceland seized the .is domain. Even ancillary services crumbled: hCaptcha, Google Voice, registered agents, mailing addresses. "There is no amount of money I can throw to convince people to be brave and be free," the operator wrote. "I am one person." dchan has none of these. The swarm has no throat to choke. Picard roared in *Star Trek: First Contact*, "The line must be drawn here! This far, no further!" against the Borg's threat. dchan echoes this stand to shatter corporate chains, empowering the swarm to claim their stake in an uncensorable internet. The people, not monopolies, command the flow of ideas.

Building on this foundation, dchan's solution leverages a hybrid architecture to achieve post-scarcity communications.

4 Forging the Solution

4.1 Hybrid Design for Post-Scarcity Communications

4.1.1 The Music Industry's Lesson

The term "post-scarcity" borrows from economics: when supply exceeds demand so thoroughly that scarcity no longer constrains access. The music industry glimpsed this future first. When Napster democratized distribution in 1999, the RIAA responded by suing over 30,000 individuals—including a twelve-year-old girl and a deceased man's estate[14]. The backlash was catastrophic. Album sales kept declining anyway. Steve Jobs offered a different answer: iTunes launched in 2003 with 99-cent songs, replicating Napster's vast catalog and convenience while giving labels their cut[15]. It worked—iTunes sold five times more songs in its first week than Napster's legal relaunch. Then Spotify took it further: Sweden, home to both Spotify and The Pirate Bay, saw piracy drop 25% within two years—not through lawsuits, but through a value proposition that made paying easier than stealing. By 2008, the RIAA abandoned mass litigation entirely, pivoting to targeting infrastructure: torrent sites, tracker operators, anyone with a server to seize.

4.1.2 The Lesson They Forgot

Netflix learned from this playbook. Compete on convenience and price, not litigation. For a decade, it worked. Piracy declined. Cable died—subscriptions fell from 90% of US households in 2009 to barely half by 2025[16]. Streaming had won.

Then the winners got greedy. Netflix's standard plan rose from $9 in 2015 to $18 in 2025. Disney+ doubled its price in four years—a milestone that took Netflix fourteen[17]. YouTube TV launched at $35 per month in 2017; by 2025, it costs $83. Americans now pay $121 monthly for ad-free streaming across services, up from $100 just a year prior. Password-sharing crackdowns. Ads inserted into plans that were sold as ad-free. Content pulled without warning as licensing deals expire.

"Streaming has become as much of a financial burden as cable," one consumer told The Washington Post[18]. She's not alone. Piracy site visits more than doubled from 104 billion in 2020 to 216 billion in 2024[19]. One in three Americans now admits to pirating content in the past year. When surveyed, 75% of pirates said they'd pay for streaming if it were cheaper[20].

The lesson didn't stick. Centralized services will always, eventually, extract rents. The value proposition that defeated piracy erodes the moment shareholders demand growth. Netflix beat piracy by being better than free; now it's trying to be more expensive than cable. The cycle repeats because the incentives never changed.

4.1.3 The AI Inflection

AI breaks this cycle—but not in the way the music industry feared. AI doesn't create piracy; it creates *abundance*. When creation costs approach zero, the scarcity isn't distribution anymore—it's attention. Right now, hobbyists are producing Star Wars fan films[21], X-Men animated recaps[22], and satirical TV reboots[23] using open-source tools for video generation[24], voice cloning, and AI cinematography that can simulate entire film crews[25]. Anime creators are reviving classic styles without studios[26]. Elon Musk predicts the first compelling AI-generated TV show by 2026, fully AI-driven video games within three years[27]—and frames this as a fundamental shift where digital content becomes so abundant that only live experiences retain scarcity value[28]. When anyone can produce studio-quality derivative works from their bedroom, fan fiction isn't a niche—it's an avalanche. The Copyright Office admits "some uses will qualify as fair use, and some will not"[29]—which means years of litigation with no clear rules, courts overwhelmed by volume, and public discourse fracturing over what "derivative" even means.

4.1.4 The New Censorship

Here's what makes AI different from piracy: corporations can't sue their way out of abundance. The RIAA learned that suing customers destroys goodwill. Studios won't repeat that mistake at scale. But they've found a subtler weapon: voluntary restriction that goes *beyond* what the law requires.

When users began generating videos of Martin Luther King Jr. using OpenAI's Sora, the King estate objected[34]. There's no universal legal protection for the likeness of deceased historical figures—MLK's speeches entered the public domain, and his image as a public figure enjoys limited protection at best. OpenAI could have cited fair use and free speech. Instead, they capitulated: Sora now blocks MLK generations entirely at the estate's request[35].

This isn't caution—it's the business model. OpenAI has signed licensing deals worth over $250 million with News Corp, tens of millions annually with Axel Springer, and similar agreements with dozens of publishers[36]. Train on everything, then selectively restrict output based on who complains loudest—or who pays most. The platform that trained on the entirety of human creative output now decides, deal by deal, which outputs you're permitted to generate.

The endgame isn't content moderation—it's infrastructure capture. OpenAI positions itself as the gatekeeper between users and fair use, sharing revenue with rightsholders in exchange for controlling what you're allowed to create.

4.1.5 The Infrastructure Trap

This is why infrastructure matters more than platforms.

When corporations can't sue individual creators, they'll capture infrastructure instead. We've already seen the playbook. Viral creators sign contracts that surrender creative control to corporate entities[37]. Platforms capture value from the communities they host. Centralized AI services voluntarily restrict content that the law would permit—then monetize the permission to create. When you depend on their infrastructure, they own you—your content, your audience, your creative freedom.

The pattern is clear: every centralized service eventually capitulates. To shareholders demanding growth. To estates demanding control. To governments demanding compliance. To licensors demanding revenue share. The only question is when.

4.1.6 The Outposts of Resistance

dchan exists because there must be infrastructure that *can't* capitulate.

Centralized platforms fail because they have single operators who absorb legal pressure, revenue models that force them to cut licensing deals, and infrastructure concentrated in seizable data centers. The question isn't *if* they restrict content—it's *when*.

dchan inverts this. Validators run distributed across jurisdictions—no single government can shut down the network. The torrent community has survived 22 years of legal assault using the same playbook: geographic distribution, redundancy, and operators who know how to persist under pressure. dchan aligns with this proven track record intentionally.

The core protocol doesn't depend on revenue to function. Instead, it runs on reputation—soulbound tokens track contribution the way private tracker communities have for decades. Monetization happens in optional layers built on top, not baked into the protocol's operation. When the base layer has no financial stake in restricting content, there's no economic pressure to capitulate. Platforms cut licensing deals because shareholders demand growth. The protocol has no such pressure point.

No central infrastructure means no single server to raid, no data center to block, no CEO to compel. When pressure is applied, it dissipates across a distributed network with no mechanism to enforce compliance.

The protocol refuses to adjudicate. It cares about whether someone is willing to seed. Let the courts decide what's legal. The swarm decides what persists.

Section 5 details how blockchain-anchored metadata and BitTorrent distribution achieve this structural immunity.

5 System Design

Blockchain, CDN, and Swarm Coordination

5.1 BitTorrent CDN

The BitTorrent v1-powered CDN achieves:

- **Storage**: Content resides in the BitTorrent DHT, seeded globally across peer nodes.
- **InfoHash Indexing**: 40-character SHA-1 infohashes are indexed on-chain, enabling discovery and verification of torrent content. On-chain infohash indexing transforms ephemeral magnet links into permanent records. Traditional torrent sites maintain centralized indexes—easily seized, subpoenaed, or deleted. By anchoring infohashes to the Edamame Chain, dchan creates an immutable catalog that no court order can erase. The blockchain becomes the library card catalog that cannot be burned. Discovery persists even when individual trackers fall.
- **BitTorrent v1**: Uses standard BitTorrent v1[39] with SHA-1 hashing (40 hex character infohashes), ensuring compatibility with the global BitTorrent ecosystem and existing torrent clients. BitTorrent v1 isn't a compromise—it's a strategic choice[40]. SHA-1's theoretical weaknesses are irrelevant when the threat model is censorship, not collision attacks—and the protocol's survival record speaks for itself (see Section 3).
- **Access**: A planned WebRTC gateway will bridge browser clients to the BitTorrent DHT, enabling direct peer-to-peer content access without requiring users to run full BitTorrent nodes. (See Roadmap, Phase 3.)
- **External Content**: Users can seed external torrents (e.g., datasets, software, archives), extending dchan's utility beyond image boards to function as a general-purpose CDN. Seeding-specific incentives are planned for future phases (see Roadmap).
- **Tagging System**: Content is organized via governance-controlled tags, enabling categorization and discovery across the swarm. Tags are semantic infrastructure, not censorship tools. Governance creates the shared vocabulary through which the swarm organizes content—voting on whether /linux/ or /gnu-linux/ becomes canonical, preventing the fragmentation that makes search useless. But tagging content? That's author authority. Removing tags from content? Not a governance power. The protocol provides `MsgCreateBoardPost` with embedded tags—authors tag their own work. No `MsgRemoveTagFromPost` exists for governance to weaponize. Structure by consensus, expression by individual sovereignty.

5.2 Edamame Chain Blockchain

Definition 5.1 (Edamame Chain)**.** A Cosmos SDK[41] layer-1 blockchain using CometBFT consensus to order transactions, validate metadata, and enable FREE content posting through specialized ante handlers.

The blockchain provides:

- **Consensus**: CometBFT[42] (formerly Tendermint[43]) provides Byzantine Fault Tolerant consensus with instant finality, tolerating up to 1/3 malicious validators.
- **FREE Transactions**: The `FreeEdamameTxDecorator` ante handler enables zero-fee transactions for content operations (posts, comments, tags). Users never pay gas for posting—freedom of expression has no transaction fee.
- **Governance-Only Boards**: Board creation requires governance proposals, ensuring community consensus on content organization while preventing spam board creation. Governance curates the namespace, not the content. Think of it as zoning without eviction power: the community decides where forums are built, but cannot bulldoze homes once occupied. A new board requires governance approval—intentional friction against namespace squatters and spam

floods. But posts within boards? Untouchable by protocol design. No council vote deletes your manifesto. No majority erases your dissent. dchan draws a bright line: collective decisions on structure, absolute freedom on speech.

- **Content Messages**: Core transaction types include `MsgCreateBoardPost` (post content with embedded tags and optional infohash), `MsgCreateComment` (threaded replies), and `MsgDeleteBoardPost`/`Msg` (author-only deletion).
- **Cryptography**: Ed25519 signatures provide fast verification (sub-millisecond), standard across the Cosmos ecosystem.
- **Soulbound Tokens**: MISO tokens are non-transferable by design—`default_send_enabled` is set to `false` in genesis, making all tokens soulbound to the addresses that earned them.

The chain stores torrent infohashes, board metadata, and governance state, enabling permissionless posting with zero transaction fees.

5.3 Edamame Torrent Sidecar

Each validator runs an `edamame-torrent` sidecar—a pure Go application built on the anacrolix/torrent library[44]—that bridges the blockchain to the BitTorrent network:

- **gRPC Interface**: The sidecar exposes a gRPC API for the chain to request torrent operations (seeding, metadata fetching, peer discovery).
- **DHT Integration**: Full BitTorrent DHT[45] participation enables peer discovery without centralized trackers. Centralized trackers are castles: visible, valuable, vulnerable. Authorities know where to serve papers, which servers to image, whose door to knock on. The DHT is a fog: distributed across millions of nodes, with no central index, no responsible party, no kill switch. Every major torrent tracker has eventually succumbed to legal pressure, infrastructure costs, or operator fatigue. The DHT persists because it has no single point of failure—no domain registrar to pressure, no hosting provider to terminate, no founder to exhaust. dchan builds on the survivor, not the pattern of casualties.
- **Metadata Resolution**: Given an infohash, the sidecar fetches torrent metadata (file names, sizes) from the DHT via BEP-9[46].
- **Pure Go**: No CGO dependencies ensures easy cross-compilation and deployment across platforms.

This architecture separates blockchain consensus from BitTorrent networking, allowing each component to scale and evolve independently. CometBFT requires deterministic state transitions—a mathematical invariant, not a suggestion. BitTorrent operates over the chaotic internet where packet timing, peer availability, and DHT routing are fundamentally unpredictable. These two systems cannot share a process. If a validator's state depends on "which DHT node responded first," consensus is impossible—network latency varies per validator location, producing different states, different hashes, failed blocks. The sidecar pattern resolves this tension: `edamame-torrent` handles the nondeterministic swarm, `edamame-chaind` maintains deterministic state. The chain stores what CAN be agreed upon (infohash exists, metadata hash matches); the sidecar handles what CANNOT (peer counts, network timing). Blockchain determinism preserved; BitTorrent distribution enabled.

5.4 Soulbound Tokens

Definition 5.2 (Soulbound MISO Tokens)**.** Non-transferable reputation tokens[47] permanently bound to the address that earned them, incapable of sale, transfer, or speculation.

Technical Implementation: The genesis configuration sets `default_send_enabled: false` in the bank module, disabling all token transfers at the protocol level. MISO tokens are non-transferable.

Genesis Validator Set: The network launches with validators selected from private tracker operators and ethos-aligned communities who already embody censorship resistance values. These validators earn MISO tokens through standard Cosmos staking mechanics. Non-transferability ensures tokens function purely as reputation—validators accumulate standing through operation.

Future Reputation Infrastructure: The base layer provides non-transferable tokens as a primitive. Planned TEE-based solutions enable seeding verification, allowing TEE proxies to reward seeders with reputation. Additional reputation systems and business models can be built on top of this infrastructure. Section 5.8 details the TEE architecture; Section 9 outlines the phased deployment roadmap.

5.5 Content Pipeline

Content lives in the BitTorrent DHT; infohashes are indexed on-chain for permanent discovery.

5.5.1 Pipeline Stages

Stage 1: Discovery. DHT indexers crawl the global BitTorrent DHT using BEP-51[48] sampling, discovering millions of torrents by their infohash. Metadata is retrieved via BEP-9, extracting torrent names, file lists, and piece information. This stage operates entirely off-chain, requiring no blockchain interaction.

DHT Spam Prevention Layers

```
+-------------------------------------------------------------------------+
|                 DHT INDEXER SPAM PREVENTION                             |
+-------------------------------------------------------------------------+
|                                                                         |
|  THE PROBLEM                                                            |
|  ---------------------------------------------------------------       |
|  Global BitTorrent DHT is 70-95% spam:                                  |
|  - Fake torrents (announce but don't serve)                             |
|  - Malware distribution                                                 |
|  - SEO spam (fake metadata)                                             |
|  - Dead torrents (no active seeders)                                    |
|                                                                         |
|  THE SOLUTION: MULTI-LAYER VERIFICATION                                 |
|  ---------------------------------------------------------------       |
|                                                                         |
|  LAYER 1: HANDSHAKE VERIFICATION                                        |
|  ---------------------------------------------------------------       |
|  - Indexer connects to announced peers                                  |
|  - Verifies BitTorrent handshake completes                              |
|  - Confirms peer actually speaks BT protocol                            |
|  - Filters: fake announces, dead peers                                  |
|                                                                         |
|  LAYER 2: PIECE SAMPLING + CSAM CHECK (ATOMIC)                          |
|  ---------------------------------------------------------------       |
|  - Download random piece samples from seeders                           |
|  - Verify pieces hash correctly per torrent metadata                    |
|  - **SIMULTANEOUSLY** check pieces against CSAM database                |
|  - Confirms seeders have actual content AND content is safe             |
|  - Filters: fake seeders, corrupted content, CSAM                       |
|                                                                         |
|  LAYER 3: MINIMUM VERIFIED SEEDERS                                      |
|  ---------------------------------------------------------------       |
|  - Require N verified seeders before indexing                           |
|  - Default: min_verified_seeders = 3                                    |
|  - Each seeder must pass L1 + L2                                        |
|  - Filters: low-quality torrents, spam campaigns                        |
|                                                                         |
|  LAYER 4: ASN DIVERSITY                                                 |
|  ---------------------------------------------------------------       |
|  - Verified seeders must span multiple ASNs                             |
|  - Prevents single-actor Sybil attacks                                  |
|  - Default: min_unique_asns = 2                                         |
|  - Filters: coordinated spam from single network                        |
|                                                                         |
|  LAYER 5: SUSTAINED DURATION (Optional)                                 |
|  ---------------------------------------------------------------       |
|  - Track seeder availability over time                                  |
|  - Require seeding for minimum duration before indexing                 |
|  - Default: min_duration = 1 hour                                       |
|  - Filters: hit-and-run spam, ephemeral attacks                         |
|                                                                         |
+-------------------------------------------------------------------------+
```

Stage 2: Classification. On-chain classifier rules (keywords, regex patterns, file extensions) determine which board each torrent belongs to. Governance maintains these rules, ensuring consistent classification across all indexers. Rules include priority ordering, confidence thresholds, and negative keywords for disambiguation.

Stage 3: Registry. The Global InfoHash Registry observes all content references, tracking popularity (reference counts), aggregating metadata (display names, trackers), and enabling cross-entity discovery. Critically, the registry *never blocks* content—multiple posts can reference the same infohash, increasing seeder availability.

Stage 4: Enrichment. Enrichers enhance posts with metadata from external sources. Enrichment is additive and asynchronous—posts appear immediately with basic metadata, then receive rich details as enrichers process them.

Stage 5: Policy. Seeding policies control which content individual nodes serve. Operators configure pin/block rules by infohash, board, or creator. Policies affect local seeding only—they never affect

blockchain consensus or content availability on other nodes.

5.5.2 Trust Model

Content verification follows graduated trust levels:

1. **User-submitted**: Posted directly with wallet signatures.
2. **Indexer-verified**: Discovered from DHT, verified through spam prevention.
3. **Enriched**: Augmented with external metadata.
4. **TEE-attested** (planned): Cryptographically verified execution proofs.

Frontends and node operators use trust levels to determine display and seeding policies.

5.6 Content Filters (Planned)

While dchan champions absolute censorship resistance at the protocol level, ensuring no centralized authority can dictate what content flows through the swarm, future phases will empower users and node runners to exercise self-determination in maintaining ethical boundaries. Planned content filter capabilities include optional external API integration—operating in either whitelist mode (seed only approved content) or blacklist mode (seed everything except blocked content)—to screen content based on jurisdictional requirements or personal ethics, aligning with community standards rather than protocol mandates. See Roadmap for implementation timeline.

5.7 RPC API Layer

Decentralization without accessibility is gatekeeping. While dchan's peer-to-peer architecture resists censorship at the protocol level, users need practical ways to interact with the swarm—posting content, browsing boards, discovering torrents. The RPC API layer bridges this gap, providing REST endpoints that enable browsers, mobile clients, and third-party tools to access dchan without running full validation nodes.

Definition 5.3 (RPC API Layer)**.** A comprehensive HTTP REST API exposing chain state, board content, and torrent metadata to lightweight clients, following standard Cosmos SDK patterns with additional dchan-specific endpoints.

5.7.1 REST Endpoints

Dchan exposes REST endpoints organized by function:

Board Queries:

- `GET /edamame-chain/edamame/v1/boards` - List all boards with pagination
- `GET /edamame-chain/edamame/v1/board/{board_id}` - Get specific board details
- `GET /edamame-chain/edamame/v1/board/{board_id}/posts` - List posts in a board

Post and Comment Queries:

- `GET /edamame-chain/edamame/v1/post/{post_id}` - Get post with comments
- `GET /edamame-chain/edamame/v1/comments/{post_id}` - List comments on a post

Tag and InfoHash Queries:

- `GET /edamame-chain/edamame/v1/tags` - List all tags
- `GET /edamame-chain/edamame/v1/infohashes` - List indexed infohashes
- `GET /edamame-chain/edamame/v1/infohash/{infohash}` - Get infohash details and tags

Parameters:

- `GET /edamame-chain/edamame/v1/params` - Module parameters (board name limits, etc.)

All endpoints return JSON with consistent schemas following Cosmos SDK conventions.

5.7.2 Browser Gateway (Planned)

Browsers cannot directly access the BitTorrent DHT—they lack UDP sockets and native torrent clients. A planned browser gateway will bridge this gap via WebRTC, enabling browser-based dchan clients to seed and download torrents through relay nodes.

Planned Architecture:

1. Browser connects to gateway via WebSocket
2. Gateway establishes WebRTC data channels to browser
3. Gateway proxies BitTorrent protocol between browser and DHT peers
4. Browser sends/receives torrent pieces via WebRTC

Censorship Resistance: Unlike centralized tracker websites (easily seized), the gateway will be just ONE of many potential relay nodes. If a gateway goes offline, users connect to another. No single gateway controls access—anyone can run one. See Roadmap, Phase 3 for implementation timeline.

5.8 TEE Verification Layer (Planned)

The planned TEE verification layer addresses the fundamental challenge of proving off-chain work: how can the blockchain verify that a seeder actually served data to peers?

Critical distinction: Standard BitTorrent seeding requires no TEE—anyone can fire up qBittorrent, Transmission, or any torrent client and start serving content to the swarm. This is how BitTorrent has always worked, and dchan preserves it completely. The TEE layer is specifically for *rewarded* seeding: operators who want cryptographic proof of their contribution to claim MISO tokens. Ideological seeders keep the swarm alive; TEE operators add economic sustainability. Both are valuable; neither is required.

dchan's TEE infrastructure leverages established decentralized confidential computing foundations[49][50].

5.8.1 Architecture

TEE Verification Proxies run inside Intel TDX enclaves[51], appearing to the BitTorrent network as high-reputation seeders. When a peer requests content:

1. Proxy fetches the piece from any available seeder on the network
2. Proxy verifies the piece hash against the BitTorrent v2 Merkle tree
3. Proxy forwards verified data to the requesting peer
4. Proxy records an attestation: "Seeder X provided valid piece Y"
5. Attestations are batched and submitted on-chain with TDX quotes

The chain verifies Intel's cryptographic signature on TDX quotes, proving that attestations came from genuine TEE hardware running approved code. Seeders referenced in valid attestations receive proportional token rewards.

5.8.2 Trust Properties

The TEE layer provides three cryptographic guarantees:

Hardware authenticity: Intel DCAP signatures prove attestations came from real TDX hardware, not emulated environments.

Code identity: MRTD measurements prove the exact code running in the TEE matches governance-approved binaries.

Output binding: Report data in TDX quotes cryptographically binds to the specific attestation batch, preventing tampering.

5.8.3 Incentive Economics

Block rewards are distributed across three pools:

- **Consensus rewards** (configurable, default 40%): Standard validator staking rewards
- **Seeding rewards** (configurable, default 50%): Distributed to seeders proportional to verified bytes
- **Verification rewards** (configurable, default 10%): Distributed to TEE operators for running proxies

This creates aligned incentives: seeders want TEE proxies to verify their work, TEE operators want seeders to serve data, and users benefit from reliable content availability.

5.8.4 Unified TEE Image Architecture

Core contributors build and propose ONE TEE image containing four atomically coupled capabilities:

1. **Seeding Verification**: Verifies bytes served, enabling reward distribution
2. **DHT Indexing**: Crawls the mainline BitTorrent DHT to discover content
3. **CSAM Filtering**: Checks content against authorized hash databases during indexing
4. **CSAM Reporting**: Reports detected CSAM to law enforcement and child safety partners

All four capabilities exist in the same image, same MRTD hash, inseparable by design. Operators running the governance-approved image cannot perform seeding verification without the other three capabilities being present.

Third-party dependencies. Both CSAM filtering and reporting require external cooperation. Filtering requires a database provider (NCMEC, IWF, PhotoDNA, Arachnid, or equivalent) willing to work with operators. Reporting requires law enforcement or child safety partners willing to receive reports. Core contributors build the integrations; activation requires partner cooperation. This isn't theoretical paranoia—in email correspondence with one of the authors regarding decentralized infrastructure, Kiwi Farms' operator's first concern was "CSAM attacks" rendering any directory unusable[13].

The poison pill. Core contributors' willingness to build ANY of this—rewards, indexing, filtering, reporting—is contingent on the scope remaining CSAM only. Attempt to expand filtering beyond CSAM, and core contributors permanently cease all related development: no updates, no maintenance, no support. Others can fork the code and propose alternative images; governance can approve whatever they choose. But core contributors are out—permanently. We control our labor; we do not control governance. We build on our terms or we do not build.

Governance flexibility. Governance controls which MRTD hashes are approved for reward eligibility. Governance could approve images from any source. Core contributors will only build and propose images that include CSAM filtering and reporting AND exclude any filtering beyond CSAM.

Unrewarded seeding. Seeders who do NOT want rewards can still seed via standard BitTorrent—fully permissionless, no TEE required, no filtering required. The ideological swarm persists regardless of the reward layer. TEE adds economic sustainability on top of ideological resilience; it does not replace it.

5.8.5 TEE Compute Platform

Beyond the unified seeding/indexing image (which includes seeding verification, DHT indexing, CSAM filtering, and CSAM reporting as atomically coupled capabilities), the TEE infrastructure supports a general-purpose decentralized compute and hosting platform for arbitrary workloads. Any application running in TEE can submit on-chain proofs of execution, enabling trust without centralization.

Decentralized Web Hosting. TEE proxies can serve HTTPS traffic for any content addressable by hash. A website stored as a torrent becomes globally available through the proxy network:

- Static sites served directly from verified piece data
- Dynamic backends running in TEE compute workers
- TLS termination at the proxy with automatic certificate management
- Geographic distribution through independent proxy operators

This creates a "decentralized Cloudflare" where no single entity controls the edge network. Website owners publish content to BitTorrent; proxy operators earn rewards for serving it; users access sites through standard HTTPS with no special software.

Verified Compute Services. TEE workers extend beyond simple proxying to general computation:

- **API backends**: REST/GraphQL services with attested responses
- **ML inference**: Models running in TEE with proof of which model executed
- **Content classification**: Automated tagging with cryptographic proof of algorithm
- **Metadata enrichment**: TMDB/AniList fetching with verified, unmodified results
- **Custom indexers**: Crawlers for specialized content discovery (note: the mainline DHT indexer is part of the Unified TEE Image, not a separate compute worker—see above)
- **Oracle services**: External data feeds with TEE attestation of source

This enables a new category of decentralized services: applications where users don't trust the operator, but *do* trust the code—verified by hardware attestation rather than reputation or stake. The compute platform integrates with decentralized TEE deployment ecosystems for permissionless workload attestation.

6 User Experience (Planned)

6.1 Dual Frontend Architecture

Building on the robust system design, dchan plans to support two complementary user interfaces to serve different use cases (see Roadmap, Phase 3):

6.1.1 Discussion Interface (4chan/Reddit Style)

A planned discussion-focused experience where users raid the swarm:

- **Boards**: Governance-created topic spaces (e.g., /tech/, /culture/).
- **Threads**: Posts with optional torrent attachments.

- **Replies**: Threaded comments with nested discussions.
- **Dynamics**: Saging signals disinterest; unseeded content fades.
- **FREE Posting**: Zero transaction fees remove economic barriers.

Like 4chan, dchan prioritizes speed and anonymity over identity verification—post first, reputation later. Unlike 4chan, content persists beyond thread pruning: torrents survive as long as anyone in the swarm seeds them, and the chain remembers every infohash forever.

6.1.2 Torrent Interface (TPB/Netflix Style)

A planned media-focused browsing experience for content discovery:

- **Grid Layout**: Visual thumbnails for media browsing.
- **Tag Filtering**: Navigate by governance-controlled tags.
- **Seeder Stats**: See peer counts and availability.
- **One-Click Seeding**: Instant torrent client integration.
- **Streaming**: Progressive download for media playback.

Like Plex, the media browser transforms raw files into a browsable library with posters, metadata, and streaming playback. Unlike Plex, no central server indexes your content—the blockchain IS the index, and no one can revoke your library card.

Both interfaces will connect to the same underlying chain and DHT, enabling users to choose their preferred browsing experience while contributing to the same swarm.

7 Security and Resilience

7.1 Defending Against Censorship and Attacks

Ensuring the swarm's security, dchan withstands:

- **Decentralization**: No central servers, no single point of failure. The swarm persists through peer redundancy.
- **BFT Consensus**: CometBFT tolerates up to 1/3 Byzantine validators while maintaining liveness and safety.
- **Spam Prevention**: Governance-controlled board creation and community moderation provide spam resistance without compromising zero-fee access for legitimate users.
- **Tariff Immunity**: Just as soy faces literal trade tariffs that stifle global flows, free speech endures metaphorical tariffs from regulators and corporations. dchan shatters both, ensuring ideas circulate unhindered.

Censorship is infeasible.[52]

8 Operator Ecosystem

8.1 Who Should Run dchan Infrastructure

dchan's resilience comes from who runs the infrastructure. Validators earn reputation through operation. TEE indexers provide optional infrastructure for seeding verification and DHT crawling. Genesis validators are selected from private tracker operators and ethos-aligned communities who already embody censorship resistance values.

8.2 Recruitment Criteria

Ideal candidates demonstrate:

- **Operational Excellence**: 99.9%+ uptime history, experience running distributed infrastructure
- **Censorship Resistance**: Proven commitment to resisting external pressure to censor content
- **Technical Capability**: Ability to deploy and maintain TEE (Intel TDX) infrastructure
- **Red Line Commitment**: Willingness to implement CSAM filtering (non-negotiable)

Target operator categories include: private tracker operators with proven moderation track records, free speech infrastructure providers, Tor and privacy advocates, open source foundations, academic researchers studying decentralized systems, established blockchain validators with high uptime, and digital rights legal defense organizations.

8.3 Explicitly Invited Organizations

The following organizations and similar entities are explicitly invited to apply as genesis operators, each assessed on their own merits:

- **Kiwi Farms**: Proven commitment to free speech under extreme pressure; survived coordinated deplatforming campaigns
- **4chan**: Longest-running large-scale anonymous imageboard; deep experience with content moderation at scale
- **Poast/Fediverse instances**: Federated social media operators with censorship-resistance experience
- **LBRY/Odysee**: Decentralized content platform operators

Disqualifying factors: History of censoring political speech, operating government surveillance infrastructure, deplatforming users under external pressure, or demonstrated pattern of capitulation when challenged.

9 Roadmap

9.1 Phases of Development

dchan development proceeds in phases, each building upon the last. Current status is indicated for each component.

9.2 Phase 0: Chain Foundation (Complete)

The base Cosmos SDK chain is operational with:

- CometBFT consensus (BFT with 3f+1 fault tolerance)
- **FREE transactions**: FreeEdamameTxDecorator eliminates gas fees
- **Soulbound tokens**: Non-transferable via default_send_enabled: false
- Governance-only board creation (no deletion, no post censorship)
- Full board/post/comment data model with cryptographic signatures

9.3 Phase 1: BitTorrent Integration (In Progress)

1.1 Sidecar Architecture (Complete). The edamame-torrent sidecar provides deterministic BitTorrent operations via gRPC, isolating non-deterministic network operations from blockchain consensus.

1.2 Tagging and InfoHash Index (Complete). Tags embedded in posts at creation time, indexed for efficient discovery. 40-character SHA-1 infohashes for BitTorrent v1 compatibility.

1.2b Global InfoHash Registry (Planned). Non-blocking observer that tracks popularity, aggregates metadata, and enables trending content discovery. Never blocks duplicate posts.

1.3 Seeding Policies (Planned). Programmable pin/block rules by infohash, board, creator, or creator+board combinations. Local policies with optional remote filter API subscriptions.

1.4 Enrichment System (Planned). Governance-controlled whitelist of enrichers who can add TMDB, AniList, MusicBrainz metadata. Additive updates that never overwrite user-provided data.

1.5 Classifier Rules (Planned). On-chain classification rules stored per-board. Governance updates rules; all indexers sync from chain for consistent classification.

9.4 Phase 2: User Experience (Planned)

2.1 Frontend MVP. Yotsuba-style imageboard interface for discussion-focused boards.

2.2 Media Browser. Plex/Netflix-style interface for media-focused boards with rich metadata display.

9.5 Phase 3+: Advanced Features (Planned)

DHT Indexer (Optional). TEE-based crawler infrastructure with atomic CSAM filtering—AVAILABLE for operators who choose to run it. Crawls global DHT, applies 5-layer spam prevention (handshake verification, piece sampling, minimum seeders, ASN diversity, sustained duration), checks content against CSAM hash databases (contingent on provider cooperation), and reports detected CSAM to child safety partners (if willing to receive reports). The DHT indexing and CSAM filtering capabilities are atomically coupled—operators cannot run one without the other. TEE attestation proves honest execution. Seeding rewards ONLY via TEE verification creates incentive alignment.

TEE Verification Proxy. Intel TDX-based validators that verify seeding in real-time, enabling trustless seeding rewards. Seeders earn tokens proportional to verified bytes served.

TEE Compute Workers. General-purpose TEE platform for trusted enrichment, classification, and on-chain attested computation. Enables decentralized web hosting, verified APIs, and ML inference with cryptographic proof of execution.

10 Conclusion

10.1 Extensions for a Decentralized Internet

Centralized platforms fold. dchan extends infrastructure that *can't*. Imageboards and Netflix-style interfaces are expressions of what the protocol enables—any application that needs to persist against external pressure. Three layers combine to create a complete stack:

1. **Content Layer**: BitTorrent mainline DHT + on-chain index provides censorship-resistant storage and discovery

2. **Delivery Layer**: Standard BitTorrent provides unrestricted P2P delivery—the swarm seeds because the swarm believes. TEE proxy network adds verified, *rewarded* delivery for operators who want to turn ideology into income

3. **Compute Layer**: TEE workers provide trusted execution for any application

Together, these layers enable websites hosted without servers, APIs that prove their honesty, and content that persists through the collective will of the swarm rather than the mercy of corporations.

Every centralized service eventually capitulates. To shareholders demanding growth. To governments demanding compliance. To licensors demanding revenue share. The question isn't *if*—it's *when*.

dchan exists because there must be infrastructure that *can't* capitulate. **The chain stores metadata—infohashes, tags, board structure. Users write this data via free transactions.** The same metadata could be posted to Bitcoin, Ethereum, or any public ledger—dchan just removes the economic barrier. Posts are torrents. Comments are torrents. Content lives in the BitTorrent mainline DHT. No validator can prevent a user from posting an infohash. No operator can stop a seeder from serving pieces.

This separation is structural. Centralized platforms fold because content and control occupy the same infrastructure—seize the server, delete the files, enforce compliance. dchan splits these. The chain is a public ledger for metadata. The mainline DHT is a permissionless network for content. Pressure on one doesn't reach the other.

The protocol cannot adjudicate. Users post, seeders serve, courts decide legality. The swarm decides persistence—as it has since the dawn of BitTorrent. The Soy Must Flow.

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