Audius
A Decentralized Protocol for Audio Content

Roneil Rumburg Sid Sethi Hareesh Nagaraj

Last Update: October 8, 2020*

Abstract

The music industry generates $43 billion in revenue but only 12% goes to content artists. Furthermore, artists have minimal control over how their music is distributed and little visibility into who is streaming it. To address these and other problems faced by artists, we introduce Audius, a fully decentralized music streaming protocol built with public blockchain infrastructure and other decentralized technologies. Audius allows artists to distribute to and get paid directly from their fans, and is comprised of the following components:

1. An efficient token economy powered by the Audius platform token ($AUDIO), 3rd-party stablecoins, and artist tokens
2. A decentralized storage solution and ledger for sharing audio and metadata
3. A unique track encryption scheme paired with a programmable mechanism to unlock user-specific proxy re-encryption keys for content
4. A discovery protocol for users to efficiently query metadata
5. A decentralized governance protocol, whereby artists, node operators, and fans are individually and collectively enfranchised in decision making about protocol changes and upgrades

The Audius protocol is live today and fully decentralized, operated by a robust decentralized community of artists, fans, and node operators, and serves nearly 500,000 users every month at the time of writing.

CRYP2NOVA

*Audius is a work in progress and the contents of this paper are subject to change. The most current version can be found at https://whitepaper.audius.co. For feedback and comments, please contact whitepaper@audius.co.

Archived copy · cryp2nova.com

Contents

1 Introduction **3**
- 1.1 Current problems . . . 3
- 1.2 The Audius project . . . 3
- 1.3 Traction . . . 4

2 Token Model **4**
- 2.1 Audius Token ($AUDIO) . . . 4
  - 2.1.1 Audius Token Distribution . . . 5
- 2.2 Stablecoin Payments . . . 5
- 2.3 Artist Tokens . . . 5
- 2.4 Why create a new token? . . . 5

3 Content Node **5**
- 3.1 AudSP: A decentralized storage protocol . . . 6
- 3.2 Upload flow . . . 6
- 3.3 Content permissioning . . . 7
  - 3.3.1 Proxy re-encryption . . . 7
  - 3.3.2 Unlock conditions . . . 7

4 Content Ledger **7**
- 4.1 Node registry . . . 8
- 4.2 Social features and fan feed . . . 8
- 4.3 Tokens and governance . . . 8

5 Discovery Node **8**
- 5.1 Discovery API interfaces . . . 9
- 5.2 Future work . . . 9

6 Governance **9**
- 6.1 Short-circuiting . . . 10
- 6.2 Enforcing node response accuracy . . . 10

7 History and Roadmap **10**
- 7.1 Genesis (05/2018—12/2018) . . . 10
- 7.2 Private Alpha (01/2019—07/2019) . . . 10
- 7.3 Testnet (08/2019—09/2020) . . . 10
- 7.4 Mainnet Launch (10/2020) . . . 11
- 7.5 Crossing the Chasm (12/2020 and beyond) . . . 11

8 Community-owned Streaming **11**

References **12**

CRYP2NOVA

Archived copy · cryp2nova.com

1 Introduction

Music creation and distribution have been dramatically changed by technology in the last two decades. Creating music no longer requires a team of producers and audio engineers; anyone in their bedroom can start with inexpensive software. Similarly, distributing music no longer requires factories that produce physical records and retail relationships for getting those records into stores; music platforms have enabled artists to distribute their own music.

Though redundant in the age of digital distribution, the network of intermediaries and middlemen that formed in the early days of recorded music still persists, thriving on the back of artists and curators while the mechanics of value transfer and accrual are still largely obfuscated [1].

In 2017, the music industry generated $43 billion in revenue but only 12% of that made its way to artists [2]. As points of comparison, NFL players capture at least 47% of the revenue generated by the entire NFL [3], and NBA players capture between 49 and 51% [4]. Centralized user-generated music distribution platforms have succumbed to the influence of legacy institutions, struggling to find sustainable business models [5, 6] as existing institutions reap the rewards of their (and artists') labor.

1.1 Current problems

We see a number of specific challenges faced by artists and fans today:

1. There is little to no transparency around the origins of artist payouts (e.g. number of plays, location, original gross payment before fees)
2. Incomplete rights ownership data often prevents content artists from getting paid; instead, earnings accumulate in digital service providers (DSPs) and rights societies
3. There are layers of middlemen and significant time delay involved in payments to artists
4. Publishing rights are complicated and opaque, with no incentives for the industry to make rights data public and accurate
5. Remixes, covers, and other derivative content are largely censored due to rights management issues
6. Licensing issues prevent DSPs and content from being accessible worldwide

1.2 The Audius project

We propose the Audius project as a solution to these problems. The mission of the Audius project is to give everyone the freedom to distribute, monetize, and stream any audio content.

The Audius protocol brings artists, node operators, and fans together in an incentive-aligned way, allowing these actors to collectively provide a high-quality audio streaming experience guided by the foundational beliefs that:

1. Users should be compensated in proportion to how much value they create for the network
2. Artists should directly engage with and transact with their fans
3. Governance power should be earned by creating value in Audius, and shared consistently between user groups contributing to the protocol
4. Prices and earnings for participants should be consistent, predictable, and transparent
5. Access should be democratized; anyone can contribute to Audius if they follow the protocol rules, and all information is publicly accessible
6. Intermediaries should be removed when possible; when necessary, they should be algorithmic, transparent, and verifiably accurate

The Audius protocol allows artists, fans, and node operators to collectively provide a high-quality end-user music streaming experience without centralized infrastructure. The protocol is comprised of the following 5 components working in conjunction:

1. **Audius token, stablecoins, and artist tokens**: A platform token and shared token economy that aligns the incentives of all participants with three primary prongs of functionality: access, security, and governance (Section 2)
2. **Content nodes**: A user-operated network of nodes to host content and permission access to content on behalf of artists (Section 3)
3. **Content ledger**: A single source of truth for all data accessible within the Audius protocol, anchoring references to content hosted by content nodes (Section 4)
4. **Discovery nodes**: A user-operated network of nodes that index the Audius content ledger and provide an easily queryable interface for retrieving metadata (Section 5)
5. **Governance**: A mechanism for modifications and improvements to Audius, which shares control among those who have created and are creating value on an ongoing basis (Section 6)

Put together, Audius creates a protocol where the shared success of the platform directly benefits the users responsible for its success.

Open-source implementations of all of these compo-

Archived copy · cryp2nova.com

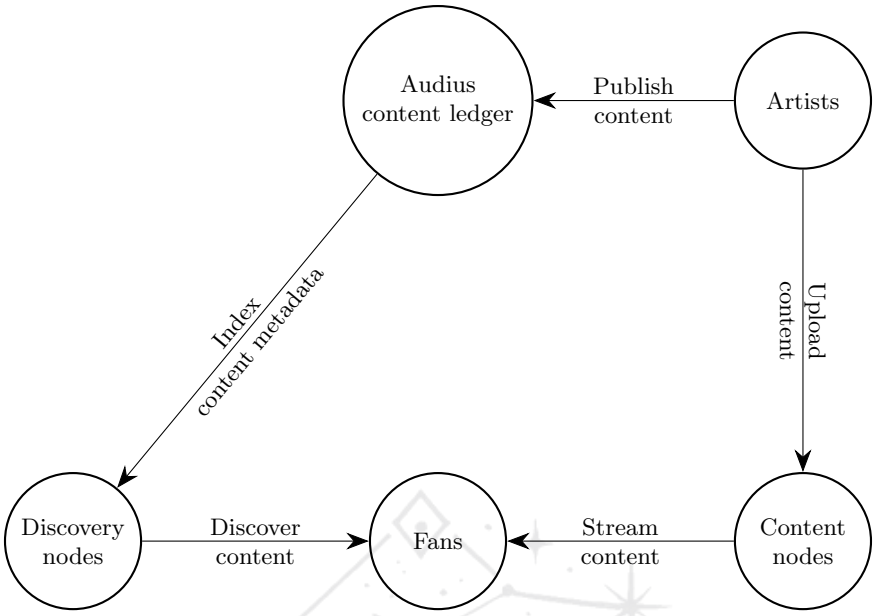


Figure 1: Audius content lifecycle

nents, live and being operated today by the community, can be found on the project's Github page.

The protocol will also require end-user facing clients—these enable users to upload content, discover and stream content, and follow one another within the network. The project team has produced an open-source reference client implementation, hosted at audius.co. Any developer may produce and distribute their own client too; many have already.

1.3 Traction

Since its beta release in September of 2019, Audius is now home to over half a million monthly active users (MAUs), with over a million monthly streams as of October of 2020. Metrics regarding the protocol's growth can be tracked in real time using dashboard.audius.org.

2 Token Model

The Audius protocol will be used by a number of different stakeholders with different goals. In order for these different stakeholders to effectively work together toward common network goals, there needs to be a unified incentive structure that aligns the interests of the individual with the interests of the protocol.

The Audius protocol is powered by the Audius platform token ($AUDIO), and with the community's support, will likely leverage 3rd-party stablecoins as well as artist-specific tokens to unlock additional functionality in future.

2.1 Audius Token ($AUDIO)

Audius platform tokens (ticker $AUDIO) have three prongs of functionality within the protocol unlocked by staking:

- Security
- Feature access
- Governance

Audius tokens are staked as collateral for a value-added services. In exchange, stakers earn ongoing issuance, governance weight and access to exclusive features.

Audius tokens are staked by node operators to run the Audius protocol, and by artists and curators to unlock exclusive features and services. Any $AUDIO staked within the protocol is assigned governance weight, used to shape future iterations of the protocol.

Audius tokens will serve as collateral for artist-based tooling as well. Early examples incubated by the community include artists tokens, badges and earnings multipliers. In the future, fans may delegate tokens to specific artists and curators to share in their growth on the platform and the issuance of future tokens.

Node operators must stake Audius tokens to operate a discovery node or content node, with a larger stake correlating to a higher probability of being chosen by

Archived copy · cryp2nova.com

fan clients. Node operators receive direct upside from seeding in the form of $AUDIO and the possibility for future protocol fees for actively seeding the protocol.

A community goal, via governance, is to ensure that Audius tokens are always being funneled to the most value-added actors by using onchain metrics as a measurement, rather than simply to those staking the most tokens but not actively participating in the ecosystem.

2.1.1 Audius Token Distribution

Audius token will be distributed with fixed genesis allocation and by ongoing issuance modifiable by governance.

The choice to launch with ongoing issuance is grounded in the desire to continually align the network's growth with new actors and their relative contributions, rather than concentrating governance power in the hands of early actors.

Should the community see fit, a portion of ongoing token issuance will be allocated to the most active users of the protocol, dictated based on platform metrics and varying contributions in the form of discoverability, streams and platform engagement.

More details about this initial supply and issuance schedule will be provided in a separate specification document upon the release of Audius token on mainnet.

2.2 Stablecoin Payments

In future, the Audius community may choose to leverage 3rd-party stablecoins to unlock paid content. These tokens are price-stable, providing a stable unit of account to ensure that artists, fans and node operators can participate in the Audius economy without concern for price volatility. Stablecoins are divisible and freely transferable, allowing for highly divisible micropayments. This makes it easy for artists to set custom rates and for fans to issue fractional payments with little friction or rounding.

A protocol fee may be captured as a percent of stablecoin transactions, including fan payments to artists. These fees would be aggregated into a pool governed by Audius token holders.

2.3 Artist Tokens

The project team also foresees Audius providing a direct mechanism for artists to better engage their community through the distribution of artist tokens. Artists could have the ability to distribute a unique token directly through Audius, giving fans who hold a specified amount of those tokens the ability to access exclusive content.

Artist token artists stake Audius token to access distribution tools and may receive tailored support from Audius representatives on best practices regarding the usage of their token in the wider Ethereum ecosystem.

Artists routing artist tokens through Audius benefit from a tailored form of distribution, unique to the artist's discography. As artist tokens are distributed, artists must maintain a bond in $AUDIO to continue using the protocol. This stake ensures that artists are active in the distribution and maintenance of their tokens while giving fans the peace of mind that a artist has skin in the game. As tokens are distributed, a portion of all artist tokens claimed may be collected by the protocol and managed through governance.

Artist tokens are earned by fans relative to how the artist sees fit using the data and interaction mechanics available natively in the protocol. Artists could use their token to limit access to token-restricted content or experiences such as unreleased tracks, stems and exclusive remix competitions.

Audius serves as an aggregator of artist tokens across issuance platforms such as Roll, Zora and Rally—any interoperable token can be allocated with the protocol-native distribution mechanisms.

Governance will play a key role in the structuring of these distribution channels along with the conditions which artists must meet to create their own token on Audius.

2.4 Why create a new token?

For value transfer in the Audius ecosystem, third-party stablecoins allow micropayments to occur in real-time, without oversight from a trusted third party to facilitate the distribution, accounting or collection of royalties and network fees. Stablecoins are pegged 1:1 to the US Dollar, providing a trusted unit of account with the inherent benefits of smart contract composability.

Audius tokens exist to align governance and financial incentives that increase protocol usage and create long-term protocol value. Participation in governance, as a node operator, artist or user, allows stakers to earn a claim on future issuance, incentivizing value-added actors to increase protocol usage to drive demand back to Audius tokens.

The inclusion of extendable assets like artist tokens allows Audius to play an active role in the wider Ethereum and DeFi ecosystem, without having to recreate the tokens, tooling, and primitives.

3 Content Node

Content nodes maintain availability of content and metadata in Audius on AudSP, the Audius-native extension

Archived copy · cryp2nova.com

to IPFS. These nodes can be run by node operators alongside an active network stake, giving them the opportunity to earn part of the ongoing Audius token issuance and aggregated fee pools, or can be run by a artist themself to host their own content.[1]

By default, a artist's client elects a set of these nodes to maintain availability of content automatically on the artist's behalf—the vast majority of artists do not need to have any knowledge of this proces. When relying on the 3rd-party network of Audius content nodes, after electing an initial set of nodes this set evolves automatically, with new nodes replacing old ones that are taken offline or become unavailable.

If the artist chooses, though, they could select self-hosted node(s) to host their content instead. Running their own content node(s) gives artists a higher degree of control over their content distribution by 1) keeping control of content encryption keys on infrastructure they control and 2) allowing for custom permissioning extensions that are not native to the protocol.

If a artist fails to satisfy the election process or the self-hosting process, their content will not be retrievable by participants in the network.

3.1 AudSP: A decentralized storage protocol

Files distributed through the Audius protocol must be highly available, independently verifiable, and decentralized. These principles are key to ensuring democratic participation and accessibility for all users of the Audius protocol. Artists sharing their tracks and metadata, fans retrieving content, and node operators will all share longer-form information via this protocol, while references to files in this protocol will reside in the Audius content ledger. Additionally, the storage protocol must provide an equivalent user experience to existing centralized solutions and scale effectively as network demand increases.

To that end, we propose AudSP: a decentralized storage solution for the Audius network built on IPFS (InterPlanetary File System). IPFS enables modular object-level encryption, global distribution capability, secure content addressing, and object immutability [7, § 3.5.4]. In order to ensure high availability for files stored through the Audius protocol, AudSP provides a staking-based incentive structure for users to host network content.

[1] Previously, there was a concept of a "creator node" that was separate from a content node. These have been combined into a single node type rather than being separate, with "content node" referring to the merged type. Some references to "creator node" still exist in Audius code and in other documentation; those can safely be assumed to be referring to the content nodes outlined here.

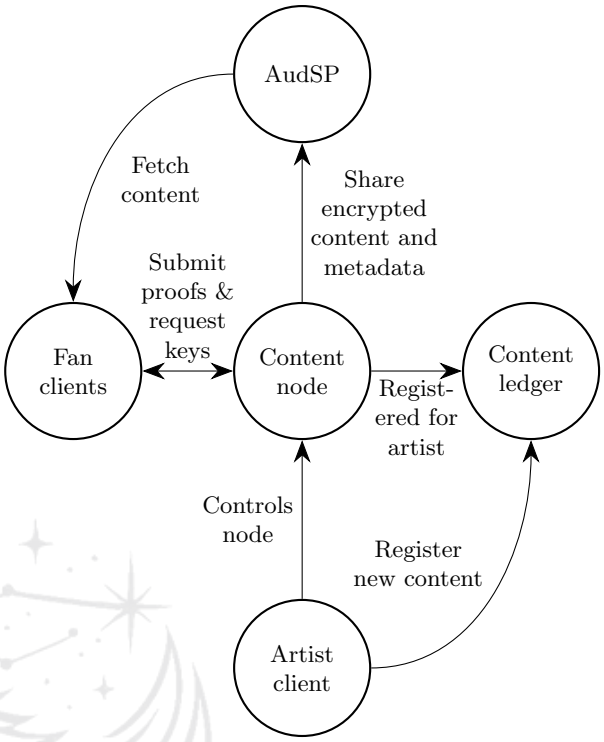


Figure 2: Content node interactions with protocol participants

File references and associated metadata stored in the Audius content ledger will be IPLD links [8]. As the decentralized storage market matures, the Audius protocol may be extended to include other storage solutions such as FileCoin [9], Sia [10], or Swarm [11].

3.2 Upload flow

To distribute a track on Audius, artists must agree to the Audius open license (this license will be published in a separate brief), making the content available on the broader Audius network.

The artist's client will then (1) slice the track into fixed-length segments, (2) encrypt them locally (if the content is permissioned) with segment-specific keys, and (3) upload these encrypted segments, the encryption keys, and required metadata to their content node(s). The content node(s) then publish the content and metadata to AudSP, producing an IPLD link for the metadata which the artist client adds to the Audius content ledger via a new transaction (See Section 4 for more on this process), which then prompts the discovery nodes on the network to index the new content and make it more broadly discoverable and available (see Section 5 for more on this process).

Archived copy · cryp2nova.com

3.3 Content permissioning

In addition to maintaining content availability, content nodes also take responsibility for permissioning access to content.

The content permissioning system in Audius aims to be:

1. Transparent for all parties involved
2. Cost- and time- efficient for all transactions
3. Flexible, accounting for multiple streaming models and any monetization scheme the artist sees fit
4. Granular, with users paying each other directly and immediately for services rendered when possible

As described in the upload flow in Section 4, if content is permissioned, the artist's client at upload time generates encryption keys for the content that are shared with / managed by the content node(s) elected by the artist thereafter.

Because of AudSP, anyone can now fetch the encrypted content being kept available by the elected content nodes. Proxy re-encryption is what allows a content node to selectively issue a key to a given user upon request.

3.3.1 Proxy re-encryption

When beginning to stream a track, a fan's client will make a request to one of a artist's elected content nodes, including a payment or other proof if required, for a proxy re-encryption key specific to the segment of the track being consumed.

To service this request, the content node derives a proxy re-encryption key using the fan's public wallet key and the private key used to encrypt the requested track and returns it to the fan. Because the re-encryption key is specific to the artist, fan, and segment, it can be transmitted insecurely or published without revealing the track contents to the greater network.

The cryptosystem used to encrypt tracks will allow the issuance of fan-specific proxy re-encryption keys derived from the track encryption key and the fan's public key. The artist's content node(s) will handle key requests and issue new keys when the specified conditions are met, issuing a new key by mixing the track encryption key with the fan's wallet's public key.

After fetching encrypted content and a re-encryption key, the fan client would locally decrypt the content using their wallet private key as follows:

```
proxied = reencrypt(encrypted_content,
                    reencryption_key)
plaintext = decrypt(proxied,
                    wallet_privkey)
```

This decrypts a given piece of content by locally re-encrypting it using the aforementioned key and subsequently decrypting it with the user's own private key. There is no 3rd-party proxy, but proxy re-encryption applied in this way allows everyone to share the same encrypted content while users can only decrypt the content on a case-by-case basis. Potential cryptosystems, including AFGH [12], are still being evaluated by the community at this time.

3.3.2 Unlock conditions

Artists can tie ability to unlock any piece of content to any condition they choose—some unlock conditions native to the protocol, if the community chooses, could include:

- A payment being made
- Sufficient holding of an artist's token (see 2.3)
- Past streaming behavior attested by a discovery node, including but not limited to:
  - following the artist
  - streamed artist's work more than a given number of times
  - reposted artist's content more than a number of times

The content node would look for the specified condition to be satisified to issue a proxy re-encryption key at the fan's request.

By running their own content node, a artist could permission content in any additional way they see fit. Their node software can be modified to add new unlocking permission modules, serving as a testbed for modules to make their way into the core protocol too.

4 Content Ledger

The Audius content ledger, referred to as such throughout the paper, is the amalgamation of smart contracts on Ethereum [13], POA network [14], and other future L1 or L2 blockchain networks that host pieces of the Audius ecosystem. Different parts of the Audius protocol will continue to run on different blockchain-based platforms, or utilize off-chain scalability solutions, where scalability trilemma tradeoffs [15] can be made on a module and subprotocol-specific basis.

Today, the content ledger for Audius includes:

- A consistent audio content and metadata format specification to ensure accessibility (similar to the OMI metadata spec [16, § 3.7.1-3.7.2])
- A decentralized process for artists to control:
  - Track content

Archived copy · cryp2nova.com

  - Revenue splits
  - Content ownership structure

- A registry of all nodes reachable in Audius
- The social graph of all users interacting with Audius
- Implementations of the token and governance systems described in this paper

After generating upload artifacts from their content nodes, as described in Section 3.2, a artist can add their content to the content ledger via a new transaction:

```
Track {
   owner_address
   map(artistId => ownership)
   metadataIPLD
   ... other metadata ...
}
```

Where the linked metadata could be a JSON file structured along these lines:

```
{
  "trackTitle": "...",
  "segmentIpldLinks": ["...", "...", ...],
  ... other metadata ...
}
```

The artist can then modify track content/metadata by sharing the modified content to AudSP and updating the metadata IPLD link in the content ledger.

Once content is listed in the content ledger, it is indexed by the discovery nodes as detailed in Section 5 which ultimately makes it easily queryable and discoverable by clients accessing Audius.

4.1 Node registry

The Audius content ledger maintains a single source of truth for 1) all the valid versions of node software usable within Audius, controlled by governance (Section 6), 2) all the discovery and content nodes reachable within Audius and 3) how to find them (via IP address or fully-qualified domain name).

When a client connects to Audius for the first time, it can use this on-chain registry to bootstrap its local state (eg. looking up which account maps to the active wallet, what is the current user's social graph / feed, etc. via a chosen discovery node)

4.2 Social features and fan feed

The content ledger also serves as a central source of truth for fan/artist interactions happening within Audius. Users can take the following actions within Audius:

- Stream a track
- Like a track, adding it to the fans' own library
- Follow other fans and artists, and receive notifications when new original content, reposts, playlists, or comments are created by them
- Create a public (shared to followers) or private playlist
- Repost tracks to followers

With more action types to be added in future via community governance (eg. comments have been a commonly-requested addition). Actions taken by users get organized into user-specific feeds that reflect the time-sorted actions of the other users they follow—this is enabled by the indexing functionality described in the next section.

All social actions within Audius are represented in the content ledger, meaning users can use any client to connect to Audius and see the same social graph. Fans can also view what other fans have been streaming, as can developers building third-party clients. This opens up many possibilities around content recommendation systems and alternative client experiences built by members of the Audius developer community.

4.3 Tokens and governance

The Audius content ledger is also the home of the Audius token economy (Section 2) and Audius governance system (Section 6), described in further detail in their respective sections.

5 Discovery Node

In order for a fan to discover content on the network, Audius needs a mechanism for indexing metadata that is efficiently queryable by users. Based on the philosophies of the Audius project, this index must be:

- Decentralized
- Efficient and straightforward for user clients to consume (promoting accessibility)
- Provably correct and transparent, eliminating profit incentives to manipulate the results returned to users
- Extensible, so that the Audius community can explore different ranking and searching methodologies.

These requirements rule out the most decentralized options due to usability and efficiency issues, e.g. users replicating the Audius ledger locally and querying their local dataset. This section outlines a protocol for a class of discovery nodes to form operated by the Audius community, serving this function in a way that meets the

Archived copy · cryp2nova.com

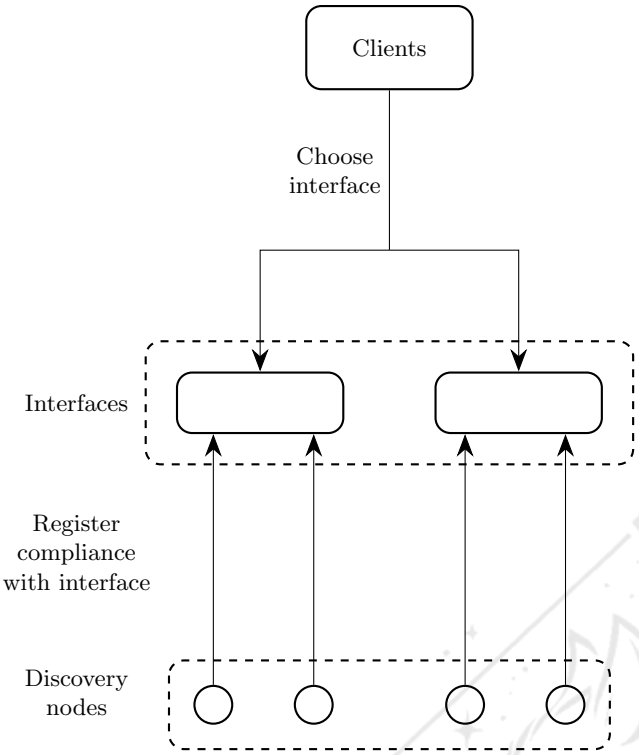


Figure 3: Discovery API interface registration and usage

above requirements.

Discovery node operators earn revenue by registering a node with an active network stake, letting them earn part of the ongoing Audius token issuance and aggregated fee pools. Fan clients select discovery nodes to query from via the content ledger's node registry (Section 4.1).

Discovery nodes are read-only. Clients can use them to fetch a fan's feed, a playlist, song and artist metadata, search the corpus of Audius entities, and execute other queries about the network. Anyone can register a discovery node if they meet the requirements outlined in this section.

5.1 Discovery API interfaces

Audius will produce a first-party discovery API interface, but other community members are encouraged to author their own interfaces that extend or modify the core API. The protocol allows fans to select any discovery API interface registered in the Audius content ledger.

An API interface must index new blocks from the Audius ledger atomically (i.e. all-or-nothing), and all API methods must be deterministic. Because of these requirements, for a given block hash, all discovery nodes running a given API interface will produce identical results for the same query. This consistency guarantee is essential for the penalty mechanism described in Section 6.2.

5.2 Future work

We foresee the community creating an incentive economy around discovery node interfaces, which would allow the creator / maintainer of an interface to earn a portion of rewards earned by node operators using said interface. Node rewards could also be tied to number of requests fielded to incentivize nodes to operate with higher-quality infrastructure and in locations near large population centers.

6 Governance

Integral to achieving this mission is a decentralized governance protocol, whereby artists, node operators, and fans are individually and collectively enfranchised in decision making about protocol changes and upgrades.

In the spirit of creating a community-owned and operated streaming protocol, these key actors should be empowered to shape, mend and modify underlying parameters of the Audius protocol including but not limited to:

- Feature Integrations
- Royalty Rates
- Token Distribution
- Fee Pool Allocation
- Staking Rewards

Everything in Audius is governable, and all Audius tokens staked in the protocol automatically receives governance weight on a 1 token, 1 vote basis.

Audius politicians differ in the sense that node operators are unique from artists and curators, both of which are aligned in the growth of the protocol. Governance will look to present both technical and nontechnical proposals, giving all users the ability to properly voice their beliefs without needing to run a node or have a deep technical understanding of the Audius tech stack.

For node operators, Audius governance acts as a key tool to empower decentralized content storage, providing a direct mechanism for rewards to be earned and amended in line with the costs, value and consensus of other providers on the network.

By creating a framework for users to adjust the direction of the protocol in line with their shared beliefs, Audius will curate governance to the most value-added actors, possibly tying in incentives to those who are most active.

Archived copy · cryp2nova.com

In doing so, core Audius politicians will play an active role in both future token issuance, node operator incentives, and creative mechanisms for artists to better engage their community.

6.1 Short-circuiting

There is a short-circuit process that allows both 1) proposals to be passed without broader vote if urgency requires, eg. during active exploitation of a vulnerability in the protocol, and 2) proposals to be vetoed if they are not consistent with the philosophies outlined in this paper.

This short-circuit capability will be controlled by a community multisig with an initial set of signers. Additional signers can be voted into place via the open community governance process.

The community, at any time, can vote to remove the ability to short-circuit governance if they choose, and the controllers of the short-circuit multisig have committed to not veto said proposal when the time comes to relinquish control.

The project team added this functionality to the governance process with the intention for it to be removed—it is up to the community to decide when it makes sense to take off the training wheels or whether it makes sense to have this functionality at all.

6.2 Enforcing node response accuracy

Every response a community-operated node in Audius returns is signed with the private key that was used to stake the original tokens or a designated delegate, the block hash of the block they have incorporated up to that point (for discovery nodes) or a timestamp (for content nodes), inputs provided to query, and the node software version from the public version registry they are using to generate results.

Blocks are indexed atomically in discovery nodes and API methods are deterministic, meaning that every discovery node should produce identical results for the same query, block hash, and API interface.

The content node by nature cannot provide as strong of guarantees by timestamp as the discovery node can by block numbers and deterministic indexing, but sequences of requests with responses (ordered by timestamp) signed by the operator key can provide a similar function for demonstrating behavior in a provable way.

If either node type produces invalid or inaccurate results, the signed result document returned by the node is a self-contained proof that the given node produced the given set of results.

Using these proofs as evidence, a claimant could open a governance proposal to slash a given node operator for this alleged misbehavior. The governance process can decide whether there is indeed inaccuracy, whether said inaccuracy was caused by negligence or maliciousness vs. a system error, and slash the node operators stake accordingly. Slashed tokens are burned rather than redistributed to stakers to avoid incentivizing slashes.

7 History and Roadmap

Detailed below is a breakdown of the progress Audius has made to date, culminating in a transition to protocol-owned and operated decentralized governance.

7.1 Genesis (05/2018—12/2018)

Shortly after the project was founded, the project team released an initial version of the Audius whitepaper detailing the plans for the architecture, and shipped the first functional implementations of the Audius smart contracts, content node, and discovery node.

7.2 Private Alpha (01/2019—07/2019)

6 months after founding the project, the project team began inviting early users to engage with the protocol and an early client implementation to provide feedback. In this phase, access to the product was granted on an invite-only basis and major issues were ironed out in a controlled environment before introducing 3rd-party node operators into the network.

At this time, all content uploaded to Audius was hosted on IPFS, and the client was interacting directly with the initial implementations of the content node and discovery node. The Audius client also featured a unique web3 login mechanism called Hedgehog, allowing users to sign up with an email and password in a trustless manner, rather than having to connect with Metamask. This was open-sourced as a standalone project to help other consumer-facing products achieve a higher degree of usability.

7.3 Testnet (08/2019—09/2020)

The Audius protocol began welcoming its first 3rd-party node operators into the network, with artist content and metadata being hosted by end users for the first time. Through this period, as more node operators were onboarded, the project team wound down most of their internally-operated nodes, maintaining a few as a canary mechanism to understand how the network is performing.

One month into this testnet period, at the end of September 2019, the Audius first-party client implementation launched publicly for the first time. This included

Archived copy · cryp2nova.com

basic functionality for uploading content, playing content, searching for / following artists, and more.

Over the following months, many more client features were shipped, including: notifications, mobile apps / desktop apps, remix competitions, and a well-documented API for interfacing with user-operated nodes directly.

By the end of the testnet period, the protocol was being used by over 500,000 fans every month (see Section 1.3 for more details).

7.4 Mainnet Launch (10/2020)

The mainnet launch of Audius is the genesis of the Audius platform token, allowing fans, artists and curators to earn a piece of the platform as a value-added user. Alongside the suite of client use-cases detailed previously, Audius will introduce a protocol dashboard to showcase analytics and governance for all stakeholders.

7.5 Crossing the Chasm (12/2020 and beyond)

The Audius community will roll out new mechanisms for content ownership and revenue never before possible, backed by the crypto-native primitives driving the protocol under the hood. As a platform well poised to bridge the gap between crypto and a mainstream audience, Audius will always prioritize simplicity to offer an intuitive user experience grounded in web3.

With Audius token, active participants will dictate protocol changes through an ongoing distribution to new stakeholders. To maintain governance weight, participants of the protocol must continually contribute in value-added ways, or have their governance power diluted and replaced by others doing the same.

In doing so, Audius will live forever as a protocol owned and operated entirely by its users, stewarded by community governance.

8 Community-owned Streaming

Audius stands at the forefront of pioneering the vision for a community owned streaming protocol. The community that has formed around this protocol has become formiddable, growing far beyond the reaches of the small project team that built the initial implementations of each respective component.

Audius has historically thrived on word of mouth referrals. As a protocol empowering anyone in the world to become a talent scout and capture value from that activity, growth has been highly correlated with passionate artists and curators taking advantage of the high degree of control and leverage that this community owned and operated streaming protocol provides.

With the support of many of the great builders in the space that have preceded us in the intersection of music and decentralization, Audius stands on the shoulders of giants, taking best practices around music distribution, governance, and token mechanics to create a streaming protocol that is owned and operated by its most active, valuable users.

For artists, we encourage you to take this opportunity to make your mark as an early adopter. The spectrum in which value can be created varies greatly, and the Audius community prides itself on creating opportunities for artists, curators and fans of all shapes and sizes to collectively share in the upside of the unstoppable streaming protocol of tomorrow.

To those who have been plagued by industry incumbents for the duration of their artistic career, let this be a call to arms to reimagine and pave a new path—one in which every aspect of the experience is grounded in sovereignty and decentralization.

We look forward to seeing you along the way.

Archived copy · cryp2nova.com

References

[1] Micah Singleton. *This was Sony Music's contract with Spotify*. May 9, 2015. URL: https://bit.ly/audius-sony-spotify (visited on 08/28/2018).

[2] Jason B Bazinet, Mark May, Kota Ezawa, Thomas A Singlehurst, Jim Suva, and Alicia Yap. *Putting the Band Back Together. Remastering the World of Music*. White paper. Citi GPS: Global Perspectives & Solutions, Aug. 2018. URL: https://bit.ly/audius-remastering-music (visited on 08/28/2018).

[3] Sam Mamudi. *NFL lockout ends as players OK deal with owners*. July 25, 2011. URL: https://bit.ly/audius-nfl-lockout (visited on 08/28/2018).

[4] David Aldridge. *NBA, NBPA reach tentative seven-year CBA agreement*. Dec. 14, 2018. URL: https://bit.ly/audius-nba (visited on 08/28/2018).

[5] Dani Deahl and Casey Newton. *How SoundCloud's broken business model drove artists away*. July 21, 2017. URL: https://bit.ly/audius-soundcloud-model (visited on 08/28/2018).

[6] Josh Constine. *SoundCloud sinks as leaks say layoffs buy little time*. July 12, 2017. URL: https://bit.ly/audius-soundcloud-layoffs (visited on 08/28/2018).

[7] Juan Benet. *IPFS—Content Addressed, Versioned, P2P File System (Draft 3)*. 2014. URL: https://bit.ly/audius-ipfs (visited on 08/28/2018).

[8] *IPLD Specifications*. Protocol Labs. 2017. URL: https://bit.ly/audius-ipld (visited on 08/28/2018).

[9] *Filecoin: A Decentralized Storage Network*. Protocol Labs. 2017. URL: https://bit.ly/audius-filecoin (visited on 08/28/2018).

[10] David Vorick. *How to Put Data on the Sia Network*. Nebulous, Inc. 2017. URL: https://bit.ly/audius-sia (visited on 08/28/2018).

[11] *What is swarm?* Ethersphere. 2017. URL: https://bit.ly/audius-swarm (visited on 08/28/2018).

[12] Giuseppe Ateniese, Kevin Fu, Matthew Green, and Susan Hohenberger. "Improved Proxy Re-Encryption Schemes with Applications to Secure Distributed Storage". In: *Proceedings of the 12th Annual Network and Distributed System Security Symposium (NDSS)*. 2005. URL: https://bit.ly/audius-proxy-re-encryption (visited on 08/28/2018).

[13] *What is Ethereum?* Ethereum Foundation. 2020. URL: https://ethereum.org/en/what-is-ethereum/ (visited on 10/05/2020).

[14] *Welcome to POA*. POA Network. 2020. URL: https://www.poa.network/ (visited on 10/05/2020).

[15] *Sharding FAQs*. Ethereum. 2018. URL: https://bit.ly/audius-ethereum-sharding (visited on 09/14/2018).

[16] *OMI Requirements Documentation Minimum Viable Interoperability 1.0*. Specifications documentation. July 26, 2017. URL: https://bit.ly/audius-open-music-initiative (visited on 08/28/2018).

Archived copy · cryp2nova.com