dStream - Decentralized Streaming Platform using Livepeer Network and CDN

Adarsh A. Nair, Aniketh V. Hotagi, Abdul Mateen, Ankit Kumar, and Kiran M
School of Computer Science and Engineering, REVA University

Abstract

Twitch.tv, Facebook gaming and similar content streaming platforms provide their services at a higher monetization cost, with unfair content promotion, and offer lower revenues due to rising platform costs. Most of the content uploaded to a centralized video platform is controlled by the platform owner rather than the content creator. Additionally, copyright infringement and the unauthorized distribution of protected content is a significant issue on popular video platforms. As a result, copyright protection, illegal access control, and legitimate video file distribution are needed, as well as adequate compensation for the creator's creative work. The project aims to develop a decentralized video streaming platform on top of Blockchain technology by using Smart Contracts and a shared network of transcoding computing nodes through Livepeer Network.

Keywords **—** Blockchain, NFT, Streaming, Livepeer, Content Delivery Network

1. INTRODUCTION

dStream is a native web3 app that lets streamers/virtual-event organizers create token-gated streams on the platform which helps them to make their content available exclusive to token holders. Token-Gating is a mechanism that is used in granting access to holders of a specific token or NFT. In our platform we enable token-gating with the help of web3 and the blockchain.

Instead of using third parties such as Twitch.tv, streamers can stream directly to their viewers using a decentralized platform/service. With the use of a decentralized platform/service streamers can own their content and promote freely.

2. LITERATURE SURVEY

Live streaming is a term used for broadcasting and recording media in real-time. Today, live streaming is a well know field and has huge popularity. For example, a Twitch streamer known by the name Martinez on 11 January 2021 broke the record for most concurrent viewers for a Twitch stream by an individual with 2,468,668 peak concurrent viewers. With the growing popularity of these streaming platforms grows the price to use the service. Streamers pay 50% of their earnings to the platform for their service.

These centralized platforms have unfair control over who is enforced with the policies. There have been multiple instances where these central platforms do not always follow

through their own Terms of Service in instances which would benefit the platform from a business standpoint. Recently, twitch a centralized streaming platform had been hacked by an anonymous data breach which resulted in the source code of the mobile, desktop and video game console clients being leaked to the public along with the earnings of the streamers.

A distributed platform offers solutions to most of the mentioned problems, and it cuts the third-party platforms. It offers peer-to-peer (P2P) connectivity which removes the chances of data breaches as only the owner accesses their details. Livepeer is a protocol that provides an infrastructure for performing computation required for delivering live streams over a distributed network of nodes.

One of the problems of establishing consumer video services today is scaling infrastructure to accommodate the demand for the rising number of streams and expanding the number of customers as new users are added. Livepeer offers a dependable service infrastructure that can scale to handle any number of streams and viewers.

While current networks such as Twitter and Facebook provide incredible live video options for reaching a wide audience, they are also often the first to be banned or restricted in a variety of political crisis scenarios. With the help of a decentralized network, it would be extremely difficult to censor streamers. [1], [2], [3], [4], [5]

3. METHODOLOGY

A. Livepeer Protocol

Livepeer is a “decentralized video streaming network built on the Ethereum blockchain” [6]. It is used as the base foundation for developing a video streaming platform. It offers us broadcaster nodes for streaming content and transcoder nodes for transcoding live video feeds. “Transcoding” is the process of reformatting a raw video file such that it works optimally on any bandwidth - whether 2g or 5g - and on any device. Livepeer provides a scalable and cost-effective infrastructure solution capable of meeting today's streaming demand. It improves reliability of video streaming and reduces the related expenses by up to 50x.

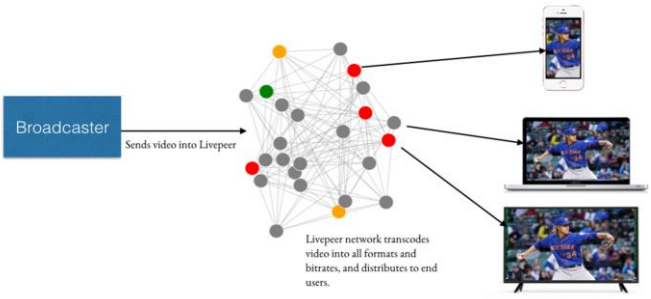

Fig. 1. Working of Livepeer Protocol.

Livepeer protocol includes two key actors – *Orchestrators* and *Delegators*.

The video feed streamed by broadcasters are received by orchestrators - users who give their CPU, GPU, and bandwidth to the network incentivized by the Livepeer network or the broadcasters to receive stable coin (such as DAI, USDT, etc.) or Ethereum Token (ETH). Orchestrators are required to stake Livepeer Token (LPT) in order to take part in the network as transcoding nodes.

Delegators are Livepeer token holders who contribute to the network by staking their tokens to orchestrators they think are doing a good job. Consider staking in the same way that you would make a deposit. When you stake, your tokens are temporarily locked and may be retrieved or staked to another Orchestrator. As a result, the network's security is increased. [6]

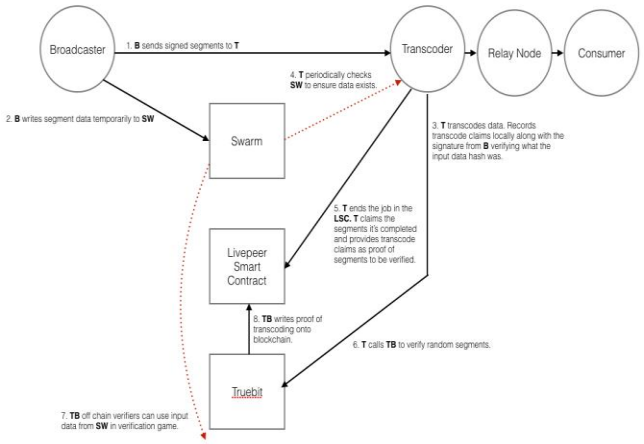

Fig. 2. A preview of roles & information flow.

B. Metamask

Metamask is a cryptocurrency wallet that supports ETH-based tokens such as ERC-721 and ERC-20. It is accessible as a browser extension. It lets the user store any assets owned on the blockchain. Metamask also provides API and utility helpers for interacting with the blockchain, it enables signing of messages required for authentication. Users are authenticated by signing a message with their private key, which generates a signature that is verified by the backend by using the user's public key.

C. NFT Tokens

NFTs are tokens that may be used to denote unique object ownership. Art, valuables, and even real estate may all be tokenized with them. Generally, an NFT token can have only one legitimate owner at a time, it is ensured with the help of smart contracts deployed on the blockchain — no one can change the ownership of the NFT token or create a new NFT.

Non-fungible token (NFT) is a term that implies to a token that is not fungible. Non-fungible is a phrase used in economics to describe items such as furniture, music files, and computers. Because these goods have distinct features, they cannot be substituted with other items. [7]

The project employs the NFT tokens and enriches the inherent value of the token by providing restricted/exclusive access to events by verifying ownership of the NFT token.

D. Moralis

Moralis is used as a tool to retrieve the publicly accessible NFT tokens that are available on a user's account and to validate the ownership of an NFT token claim that is used to access token-gated streams on the platform.

4. EXPERIMENTAL RESULTS

With this project, we successfully performed the following tasks in the application.

a. Register new users and login already registered users to the application.

b. Let users successfully and easily connect to their crypto currency wallets and retrieve their NFTs and tokens.

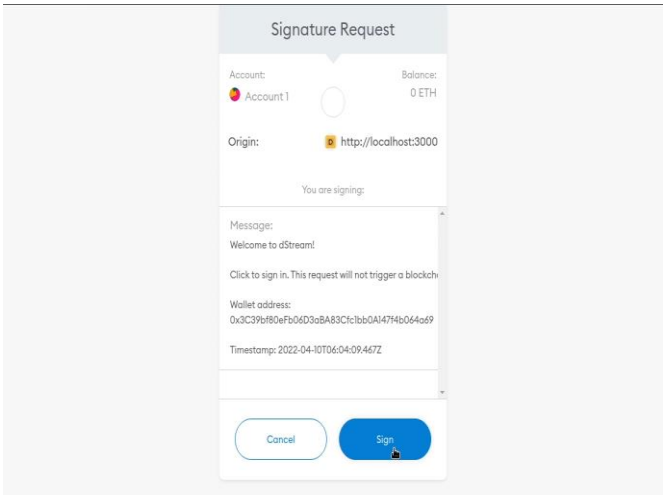

Fig. 3. Connecting to wallet using *Metamask*.

c. Let users create and list new streams and virtual events and provide them with the stream key and link.

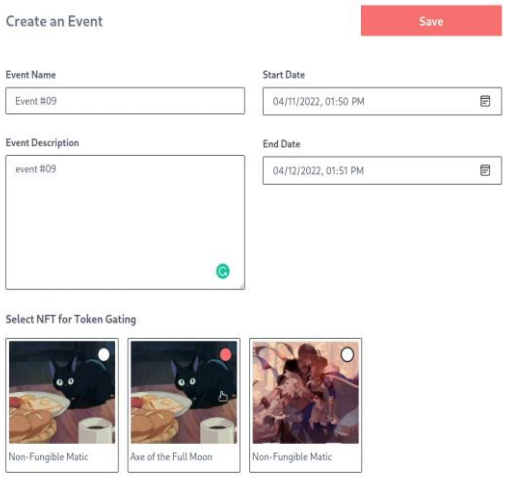

Fig. 4. Event creation page.

d. Let users start streaming with any available streaming application using the provided stream key and link.

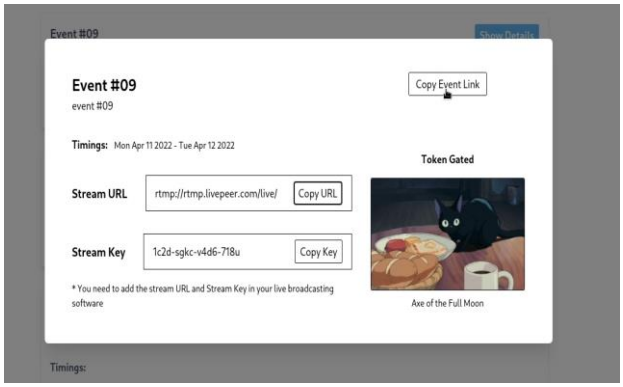

Fig. 5. Listing Stream details with keys and links.

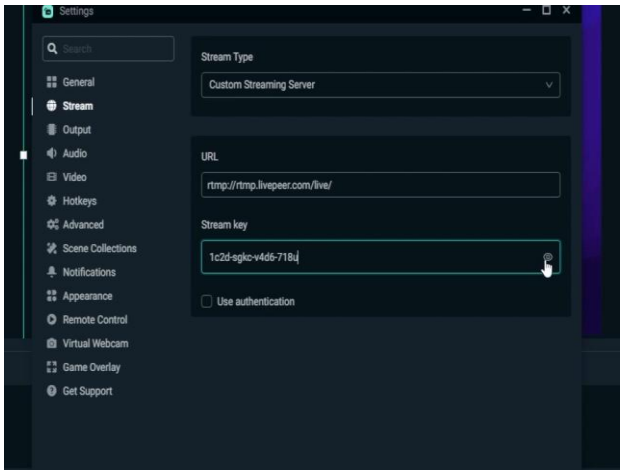

Fig. 6. Starting Stream with provided stream key.

e. Authorize users joining the stream using the link of that stream and only allow if they have the required token/NFT.

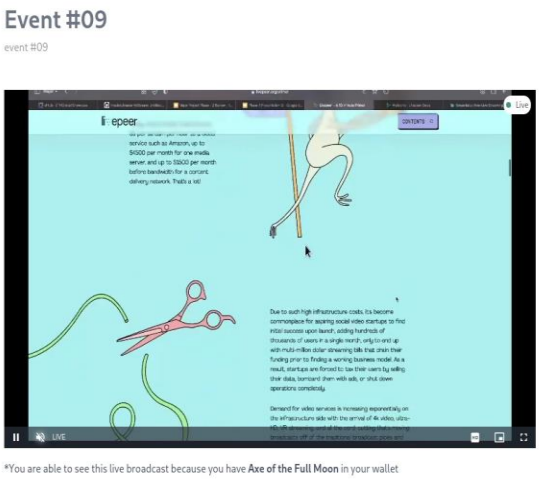

Fig. 7. Viewing the live stream using token.

The following cost is the expected cost for 1-hour long stream with 1000 concurrent viewers with 100% stream watch time.

TABLE I. Comparison between cost of Decentralized & Centralized Platform.

Parameters	Livepeer	AWS based platform
Transcoding	$ 0.30	$ 1.71
Stream Delivery	$ 17.17	$ 67.24
Multistreaming	$ 0.02	$ 0.40
Total (in USD)	$ 17.49	$ 69.35

As per the above table, the expected cost of a platform using Livepeer is *less than 30% of third-party based platforms.*

5. CONCLUSION

This proposed work removes third party between the viewers and the streamers and gives ownership of the content to its creator while being comparatively cheaper than the other alternative centralized streaming platforms.

5.1 Future Work

We plan to implement the following tasks in the application:

1. Smart contracts for storing event details.
2. Dedicated Fungible ERC20 token for donations and monetization.
3. Real-time chat integration using off-chain service / on-chain implementation with secretum. [8]

ACKNOWLEDGEMENT

We would like to thank REVA University and the faculty members for guiding us and providing all the necessary support for the team in completing the project and technical research paper.

6. REFERENCES

[1] Suvadra Baruna and Dipon Talukder, "A Blockchain based Decentralized Video Streaming Platform with Content Protection System", ICCIT, 19-21 December 2020.
[2] Doug Petkanics and Eric Tang, "Protocol and Economic Incentives For a Decentralized Live Video Streaming Network", 12 December 2018.
[3] THETA, "A Decentralized Video Delivery and Streaming Network Powered by a New Blockchain", 11 November 2018.

[4] Behrouz Zolfaghari, Gautam Srivastava and Hamid Nemati, “Content Delivery Networks: State of the Art, Trends, and Future Roadmap”, April 2020.
[5] Mythresh Korupolu and Srikanth Jannabhatla, “Video Streaming Platform Using Distributed Environment In Cloud Platform”, IEEE, 19-20 March 2021.
[6] Ramaiah, N. S., & Ahmed, S. T. (2022). An IoT-Based Treatment Optimization and Priority Assignment Using Machine Learning. ECS Transactions, 107(1), 1487.
[7] Doug Petkanics and Eric Tang, “Livepeer Whitepaper”, 12 December 2018.
[8] Matthieu Nadini, Laura Alessandretti, Flavio Di Giacinto, Mauro Martino, Luca Maria Aiello, and Andrea Baronchelli, “Mapping the NFT revolution: market trends, trade networks, and visual features”, 22 October 2021.
[9] “Secretum whitepaper, Secretum powered by Solana”, December 2021.