

A DRM Solution for Online Content Using Blockchain - A Music Perspective

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Abstract—The amount of piracy in the streaming and static digital content in general and the music industry specifically is posing a challenge to digital content owners. This paper proposes a Digital Rights Management (DRM) framework to monetize, track, and control online content across platforms. The system addresses the need to lower the barriers of entry for music bands, content reconciliation for royalty payments, and control the content after dissemination. The paper benefits from the current advances in Blockchain and cryptocurrencies. Specifically, the paper presents a digital currency (Asset Assertion (AA) token) on a permission-based Blockchain to enable the secure dissemination and tracking of the digital content. The proposed framework provides the content owner the ability to control the flow of information even after he/she releases it, by creating a secure, self-installed, cross-platform reader located on the digital content file header.

Keywords-Blockchain; Cryptocurrency; Digital Rights Management; Public Key; Private Key.

I. INTRODUCTION

Online music streaming in the United States has been increasing in the past several years. It currently accounts for 65% of the online music market share [1]. This multibillion-dollar industry is continuously faced with intellectual rights infringement. For instance, in January 2018, Wixen Music Publishing Inc. sued Spotify, a music streaming company, for allegedly using thousands of songs, without a license and compensation to the music publisher [2].

There are two main music royalty-collecting societies in the USA: the American Society of Composers, Authors, and Publishers (ASCAP) and, Broadcast Music Inc. (BMI), with hundreds of thousands of members each. If two artists collaborated on the same music album, but are members of different royalty collecting societies, they will receive different royalties, a fact that shows the discrepancy in how different organizations counts played streams. As of 2016, ASCAP and BMI alone collect and disburse payments in the range of \$1.8 billion annually on behalf of hundreds of thousands of musicians for royalties around the world. It is not the actual value of the market [3] [4]. According to the Institute for Policy Innovation (IPI) 2007 report [5], it costs the US economy more than \$12 Billion US dollars due to sound recording piracy in the US. In 2017, ASCAP and BMI announced the creation of a new comprehensive musical works database to increase ownership transparency in performing rights licensing that is expected to roll out at the end of 2018 [6].

The problem becomes more challenging when considering the online radios and the Disk Jockeys (DJs) who are mixing music live and streaming it online with an audience listening around the world. The sale and distribution of media content using a digital medium provides flexible and straightforward production, consumption, and transmission of such content. However, it also reduces the efforts needed for unauthorized usage of this data. Thus, digital media content is more easily copied, distributed, or used in a manner not allowed by law or license agreement.

The paper is organized as follows. In Section 2, the paper presents an overview of the current solutions and their problems. Section 3 presents the problem statement. Section 4 presents the proposed solution overview, and Section 5 presents the conclusion and future work.

II. CURRENT SOLUTIONS AND THEIR PROBLEMS

Lawmakers recognized the growing need to protect digital media and enact the US Digital Millennium Copyright Act (DMCA) to protect property rights. One approach to curbing the proliferation of illegal activity surrounding digital media content is to incorporate a form of Digital Rights Management (DRM) into the digital content.

Traditionally, the business model has the content owner, licensing its content to several distributors. The distributors package the content to distribute on satellite or cable to different channels and sell those channels or pay per view- for the popular event- to the content viewers.

The barriers to entry for content owners, as well as distributors and channels, are high as the cost to running a channel that is capable of creating its programming and Electronic Programming Guide (EPG) and program it to potential customers is not very trivial. Companies combine content to sell channel subscriptions and optimize their profitability. For instance, one may find the same song presented on several different radio stations, where each distribution channel is trying to maximize its audience numbers. Currently, from the content owners' perspective, they are interested in one aspect: monetizing content consumptions. The major content owners are faced with the challenge of the content streamed online, without any compensation, on shady platforms. The small content creators need aggregators and distribution partners to be able to monetize their content. From the content viewer perspective, they are forced to subscribe to channel bundles and deal with the distribution channels such as online radio

stations, where they only need to listen/watch a subset of streams that is relevant to them.

Current research attempts to use Blockchain to facilitate the compensation of the content creators using different techniques. In [7], the author uses the Blockchain and Web crawling to help the content owners to identify their online work and use the Blockchain as a proof of ownership.

More similar to this paper concept is [8], where the authors encode the software to be activated based on the Blockchain information in a system that addresses the software license. On the same school of thoughts is [9], which introduces the notion of including verification information with the file metadata to enforce the digital rights within a 4k video on a multilayer Blockchain solution.

In addition to the research efforts in the area of Blockchain and DRM, several start-ups turned to Blockchain in an attempt to address this need, to assert their rights, and to prevent unauthorized usage. For instance, Swarm, an Ethereum layer for distributed storage, along with Livepeer, are infrastructures for distributed transcoding of live video. Tokit is a crowdfunding platform where artists can issue tokens and share revenues with fans, while JAAK is a framework for decentralized content licensing and metadata handling. Furthermore, SOUNDAC, previously known as Muse, is the technology behind peerTracks, a platform that allows monetizing music when distributed across predefined distribution channels using Blockchain technology. Also, Sony published a recent patent [10] where each user claims their rights on the Blockchain. Those solutions benefit from the Blockchain technology to provide monetization tools for content creators as well as possible privacy solutions to support anonymity.

There are three distinct issues this paper addresses, namely the monetization of the content, the tracking of the content, and the protection of the content. In contrast with the current literature, this paper argues that without having a solution that takes into account those three dimensions, the solution will not be complete. Hence, the paper promotes encoding with the streamed content, an embedded payment gateway and player that is activated based on validation from the Blockchain. This format would enforce digital rights, track the usage, and monetize the content.

Figure 1 shows a stream that is encoded in as an Asset Assertion (AA) format, which includes the stream content player, the payment gateway, and the content itself in a secure AA file format.

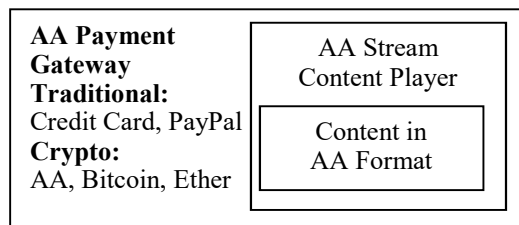


Figure 1. AA File Architecture

In this paper, an integral part of the framework is to have with each content its player to enforce the digital rights,

even after disseminating the content, which is different from the proposition in [10], where the content owner is the cornerstone of the Blockchain DRM solution. Besides, the paper fulfills the required future work mentioned in [9] where a discussion of the business model is included by compensating the listeners.

The paper presents a framework that embeds the access control policy within the file header. The access control policy validates the credentials, after checking the Blockchain posted information. When validated, the embedded player retrieves the file required codec to render the content from a separate file system, tracks and posts the usage to the Blockchain and compensates the content constituents accordingly. This process prevents the information silo and reconciliation issue existing in the industry since all constituents' exchange tokens and the transactions are recorded on the Blockchain. Furthermore, the framework presented has the ability to eliminate the content, if needed, after dissemination.

III. PROBLEM STATEMENT

Given the current state of piracy in the online music industry and the current advancement in Blockchain platforms, this paper proposes a DRM framework for the stated problems using Blockchain and cryptocurrency technology. The incentive to use Blockchain in DRM is to address three specific challenges in the current systems, namely, barriers of entry, reconciliation, and content control after dissemination.

A. Barriers of Entry

The framework should lower the barriers of entry for digital content owners, where compensation should be an option even for unpopular items, in contrast to the most widely used advertising compensation system, such as YouTube where content owners start to be compensated when the masses view their content.

B. Reconciliation

The framework should enable automatic reconciliation of content consumption. This is very hard to achieve with the current tracking frameworks since each tracking mechanism is working in a silo from each other. The framework should allow all constituents to view the same truth. To achieve this, all constituents (fans, radio stations, and content owners) should be involved in the same transaction. Using Blockchain and cryptocurrencies, the system is providing a reward mechanism to the fans to participate in the proposed eco-system to close the loop of discrepancy and to enable the additional system objective of simple reconciliation. It is worth noting that this paper uses the Blockchain after adjusting the supply chain within the content dissemination and compensates the content consumer to prevent tracking issues of content usage, especially when aggregators are introduced into the business model.

C. Content Control after Dissemination

The framework should allow content owners to control the access to their files even after dissemination. Content usage for a particular time is challenging to control after dissemination. A mechanism to control content usage after dissemination would address this challenge.

IV. PROPOSED SOLUTION OVERVIEW

In the proposed framework, after receiving AA tokens from the content owner to encode the original content in the AA file format and embed the content with a player and a payment gateway, the file header includes the digital rights possible as the access control policy. When a content consumer satisfies the access control policy constraints, usually by paying AA tokens, as depicted on the content smart contract, the content player uses the content consumer digital wallet tokens. All framework constituents exchange tokens when creating sending, retrieving, and consuming content. All token exchanges are recorded on the Blockchain, creating a single source of truth about the content. In contrast to the Sony patent [10], the Blockchain stores information from the content perspective, rather than the content creator perspective. This allows for a more straightforward reconciliation process when payments are distributed between multiple constituents.

In contrast with [9], our solution uses smart contracts to distribute the royalties, instead of using the public key encryption. One of the advantages of using smart contracts is the ability to have multiple constituents' requirements satisfied instead of having only two involved parties. This accommodates a more complex business model. The framework constituents send all transactions to the Blockchain nodes, that is, a decentralized peer-to-peer network. When the nodes reach a consensus, the transaction is then added to the Blockchain.

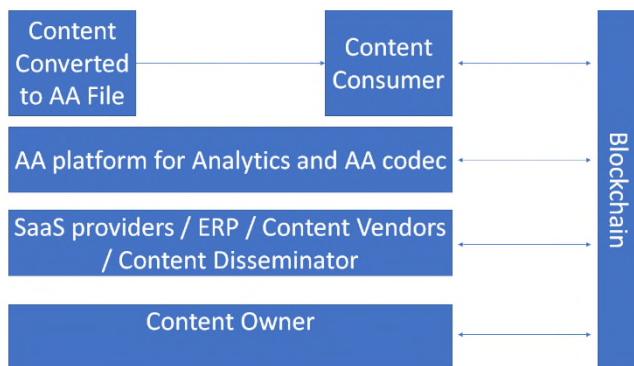


Figure 2. AA Framework

Figure 2 shows that the relation can be direct between the viewer and the content creator with the help of the AA platform in converting the content into AA format and make the file accepting payment as an independent object while ensuring the content owner’s digital rights. If the viewers or the content creators would like to gain insights about the interactions with the object, they can do this with the AA platform for analytics. The framework might reward the

viewers if they opted to share their interaction information with other interested parties. The usage of Blockchain allows for having a variation of the business model, including SaaS providers, Enterprise partners, independent content vendors, or disseminators.

A. Use Case: Buying Digital Content Rights Using the Blockchain

The permission-based Blockchain provides an open ledger solution to address the discrepancy in monetizing, tracking, and controlling online streams. It is a change in the music industry. It provides music professionals with an environment where they release their music with the confidence that their high-quality original content will be traced all the time. The transaction, once validated using the Blockchain consensus mechanism, is recorded to the Blockchain and there is no longer any confusion or debate as to the transaction and reconciliation.

The proposed Blockchain, in its purest form, is effectively a white list of legitimate online music disseminators and retailers. The smart contract assesses if the song is played on a domain as validated by its record on the Blockchain. Once the played stream is validated, the smart contract clears the transaction, and the AA token passes from the content disseminator to the content wallet, which is controlled by the content owner. If the played stream cannot be validated, it is presumed that the played stream is invalid and the AA token does not move. The outcome is recorded and provable and any potential debate over reconciliation disappears between content owners and content disseminators. Since transactions are validated in a short period of time, the Blockchain creates another change for the music industry. Payment cycles can be shortened to the time it takes the smart contract to complete. If both parties desire that, payment is nearly instantaneous. The option of reducing payment cycles from a few months to minutes is possible. The tracking agency collects a royalty, payable in AA tokens, on these transactions. These commissions are charged as a percentage of the transaction value.

B. Use Case: Blockchain to Compensate Listeners

Listeners of songs are drawn to pirated content to save money. The system can compensate them if they are enjoying a higher quality song from their preferred bands. The Blockchain gives the content consumer ownership on how to use their tracked information, if any. The Blockchain lets the listeners receive compensation. Upon consuming a digital asset, listeners receive AA tokens as a reward. These tokens can be used for many purposes within the ecosystem ranging from free ad blocking to promotional offers from similar bands.

When the transaction related to the digital asset consumption engages all involved parties in the same permission-based ledger, the value circle is closed. This allows for a single point of truth; hence, all engaged parties save on transaction reconciliation, costs and allows for new business models.

V. CONCLUSION

In summary, the paper presents a DRM framework focusing on the secure delivery of digital assets. The framework allows for generating, monetizing, tracking, and controlling access to copy-protected media files after dissemination. The system is allowing content owners, content distributors and content consumers, the freedom to pursue new business models, by making the digital content the focal point that connects all system constituents using a typical traceable transaction located on the Blockchain. This creates a single truth, rather than having information silos.

Future work includes more elaboration on the AA token, the content player, and the file format, in addition to presenting the model notation and information schematic on the information flow. Also, tracking subsections used in streamed online content and how to create a valuation model for the content disseminated and the fans using their information and influential relationships within the ecosystem are needed.

REFERENCES

- [1] C. Micames, "Sprotify hit with \$1.6 billion copyright infringement lawsuit," 18 April 21018. [Online]. Available: <http://www.ipbrief.net/2018/04/18/spotify-hit-with-1-6-billion-copyright-infringement-lawsuit/>. [Accessed June 2019].
- [2] L. I. C. Nevins and L. Fischer, "ASCAP & BMI Announce Creation Of A New Comprehensive Musical Works Database To Increase Ownership Transparency In Performing Rights Licensing," ASCAP, 26 07 2017. [Online]. Available: <https://www.ascap.com/press/2017/07-26-ascap-bmi-database>. [Accessed June 2019].
- [3] E. Christman, "BMI Again Tops \$1 Billion in Collections, Breaks Record for Royalty Distributions," *Billboard.com*, Septemeber 2016.
- [4] The American Society of Composers, Authors and Publishers (ASCAP), "2016 Annual Report," ASCAP, New York, 2016.
- [5] S. E. Siwek, "The true cost of sound recording piracy to the US economy," IPI, 2007.
- [6] A. Gomaa, "The Creation of a Cryptocurrency to Support Disintermediation," *Operations Management Education Review*, vol. 12, pp. 63-100, 2018.
- [7] M. McConaghy, G. McMullen, G. Parry, T. McConaghy and D. Holtzman, "Visibility and digital art: Blockchain as an ownership layer on the Internet," *Strategic Change*, vol. 26, no. 5, pp. 461-470, 2017.
- [8] A. Litchfield and J. Herbert, "ReSOLV: Applying Cryptocurrency Blockchain Methods to Enable Global Cross-Platform Software License Validation," *Cryptography*, vol. 2, no. 10, pp. 1-24, 2018.
- [9] J. Kishigami, F. Shigeru, W. Hiroki, N. Atsushi and A. Akihiko, "The blockchain-based digital content distribution system," in *IEEE Fifth International Conference on Big Data and Cloud Computing*, 2015.
- [10] E. Diehl, "Blockchain-based digital rights management". US Patent 15/458,807, 26 April 2018.
- [11] Paratii, "The State of Decentralised Video Q4 2017: Tubes and Flixes will never be the same. Here's why.," 18 December 2017. [Online]. Available: <https://medium.com/paratii/the-state-of-decentralised-video-q4-2017-42663ff94b28>. [Accessed June 2019].
- [12] G. Muthoni, "How Blockchain Impacts the Music Industry," Sepember 2018. [Online]. Available: <https://blocktelegraph.io/soundac-using-blockchain-solve-major-problem-music-industry/>. [Accessed June 2019].