Adopting blockchain in the digital Music Industry

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***Abstract*—Blockchain is a digital ledger platform, its most famous application is cryptocurrency. One of its main purposes is to decentralize markets. In this paper, we focus on the utilization of blockchain in the Digital Music industry. We will analyze and give various perspectives on how blockchain will benefit the music industry as whole, at the same time state the positive aspects and their limitations. We will address the current status of the platform and merge how the the innovative additions created by the high-demand streaming platforms (e.g., spotify, pandora, etc.). The aforementioned platforms attempt to re-connect the personal relationship between the artist and consumer, providing an increase in streams. The application of blockchain could reform the industry and ensure that the rightful owners get paid for their music when it plays while eliminating completely the intermediaries.**

***Index Terms*—blockchain, bitcoin, music industry, royalty payment, smart contract, ASCAP, performance rights organization (PRO), copyright**

I. Introduction

Society is very dependent [1] on technology to operate on a daily basis. Technological innovation plays a significant role on how we live organize ourselves in our daily activities. It has an impact on every business vertical - monetization and music industries are no exceptions. The Blockchain platform enables the movement of digital assets from one user to another. The development of blockchain simplifies financial transactions which in turn created a disruption [2] in centralized ledger based financing (eliminating a 3rd party as a trusted entity) and offers excellent use-cases across the globe. The platform allows for rapid transfer, thus omitting the wait time of everyday transactions via traditional financial institutions. Finally, the fees associated with the transfer decreases because there are fewer business entities involved in the transaction. This is highly favorable to the artist.

Royalty payment distribution in its present form does not favor the artist who has spent time, labor, intellectual (property) resources and energy to create the music we listen and enjoy on a daily basis. The performance rights organizations (PRO)manipulate their digital monitoring in house software to monitor airwaves for their songs. It is not different from the forensic software YouTube uses to search for potential copyright violators. This data is forwarded to record labels, along with payments collected from the stations. Then in turn, record labels use these funds to pay royalties to the artists on their label. There have been many instances where producers or songwriters do not get compensated for their creative artistic ingenuity. It is rare that you have an artist blow up - there is usually a long back-story behind this type of success. Every producer that works with an artist has a right to receive royalties when any song they have worked on streams via any digital medium. The science of tracking distributed royalty fees is not transparent - whoever uploads the song controls who will receive payment. Another major issue is Piracy. There has been a growth of applications that make it possible to download songs from streaming services. There are many businesses entities who play music publicly but do not pay the production houses. Fees managed by performing rights organizations (such as sesac and ascap) keep a large percentage of the earnings that the actual musical product pays out. Artists generally receive a small percentage for their hard work. Thus, forcing artists to reassess their role in the music industry. Two of the biggest performing rights organizations, ASCAP and BMI announced plans to create a centralized music licensing database to combat this problem, but the MIC Coalition (A diverse group of music lovers and users calling on policymakers to ensure the music economy can continue to thrive and grow) are critical of their plans. The coalition claims the aforementioned PROs have abused their power in relation to business arrangement with artists. [3]. [1].

The thesis of this study is to utilize Blockchain, and the open ledger system for all parties involved in the transaction, to be leveraged to automatically compensate the correct musical artists royalties for their songs that play in various venues. Presently, there is no authoritative body to ensure that the correct artist(s) are remunerated for their work. Additionally, by using the blockchain platform for the purpose of multiple functions (writer, composer, instrument player, etc.) will ease the compensation for their respective role concerning the music composition. By using the blockchain these issues will be eradicated. As of now, we rely heavily on human intervention, legal disputes as to who owns the piece of work and thus collects the associated payment will be easier to manage.

This study will prove that Blockchain technology can be leveraged to assist with resolving the identified issues. In theory, blockchain can furnish entity A, B, C, and D the functionality to conduct transactions directly with one another. Entity A can be labeled as musical artist A, entity B can be labeled musical label 1, party C can be labeled restaurant/business entity playing the music, and party D will be one of the governing bodies responsible for ensuring payment has been made (Fig 1). The centralized database with data related to the supply chain of the composed song life-cycle

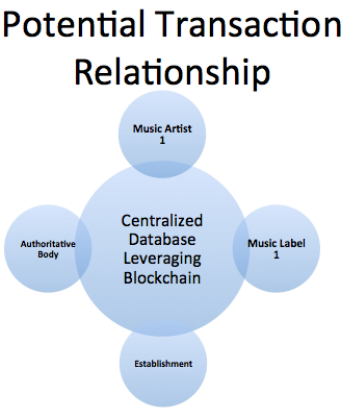

Fig. 1. Graphical representation of party A, B, C, and D and centralized database leveraging Blockchain.

would have to be referenced in the ledger for payment as well, ensuring agreement by all parties and that all entities are compensated their fair share of the funds.

Popular streaming services like Pandora, Tidal, Apple Music and Spotify can easily track which songs are being streamed by subscriber. However, when a song is played on the radio, TV, or at a club, bar, or restaurant, the companies currently depend on manual data to track statistics. TV stations use cue lists of every song being broadcast on their channels, while radio stations save play-lists of their current programming, respectively. If an artist sell their music on Pandora, CD Baby, and Spotify, they do not have a comprehensive view of what is happening with their product digitally. They are dependent on metrics that are error ridden, since the data is generated manually. Blockchain can be used to create a stable system that is entirely transparent, so if a party is not compensated, they will know automatically based on data-driven results. Artists will be able to get real-time information from digital records for their production which will be to gauge and strengthen their marketing and promotion efforts [4]. [2].

II. Literature Review

Many persons are scared of the potential disruptive impact of blockchain in the music industry [5], there is also a level of fear in the equation with some industry researchers believing that it is more important to the future of the music industry than the Internet[6]. Other researchers posit that the solution is payment in cryptocurrency, using the blockchain ledger as part of its smart contracts business model [7]. The consensus leans heavily toward the belief that blockchain technology will change the music industry for the better.

The blockchain can be utilized in many market-sectors [3], with smart contracts being the reason why. These smart contracts allow business contracts to be validated without the assistance of a third party [4], thus removing the fees that record companies and other intermediaries charge. Basically, smart contracts are contracts that self execute. The contract is responsible for the following: enforcement, management, performance, and payment of agreements between people [5]. The blockchain can administer payment between the artists at the point of sale itself in a matter of seconds with usage of smart contracts. Replacing, legal contracts that require litigation or otherwise disputed if broken, a smart contract can enforce itself via digital means when preset terms are met, and revoke the contract automatically if the conditions are violated. Ethereum is a cryptocurrency invented by 19 year old Canadian, Vitalik Buterin [5], is a blockchain well known for using smart contracts. Some suggest that Ethereum is superior to Bitcoin based on its ability to carry out smart contracts.

The digital music industry is among those industries that could use blockchain technology due to the volume of online user interaction.

Examples include:

1) In 2017, the Nielsen streaming company recorded 618 billion streams, increasing by 43% from 2016.
2) Kobalt recorded an average of 700,000 independent revenue sources per song.
3) Spotify recorded 25,000 new songs per day.
4) SoundCloud recorded 11 hours of new audio per minute.
5) YouTube recorded increases of 400 hours per minute [6].

Currently, the digital streaming model is subscriber based in addition to other formats for online transaction methods, society demands is leaning toward a future that requires less management over purchases [7]. Now, with blockchain, humanity demands to take a step even further by removing the middle-man completely from every transaction [7]. The blockchain is heavily favored because of the growing transaction costs related to the aforementioned digital music platforms. [8], Blockchain will enable many benefits such as self-regulation [9].allowing users to download, stream, and purchase digital music directly from the artist. [10] A self-regulated digital music industry will not have any need for trusted third parties that cause unnecessary costs and complicate transactions [11]. Third Parties capture our information, stopping us from monetizing it or using it to better manage our lives [5].

Blockchain will create an environment for artists to view captured data which will expose them to trends that they may not have been previously privy to. This information is crucial because it will help improve their music, make more money, and increase the longevity of their career. The blockchains inherent ability to improve the accuracy and availability of copyright data and perform near- instant micro-transactions makes the dream of having a viable career in the music industry more easily achievable,leading to more music and more transactions [12].

The beauty of the blockchain is to keep a synchronized ledger of all transactions stored within millions of computers worldwide [13]. This is done via encryption and large-scale redundancy [14], also known as super- distribution. The super-distribution concept was developed 30 years ago [15].

Blockchain is the next frontier of the world wide web. When a user sends a file to another user via the internet, in essence the user is sending a copy of the original. The issue with digital currency is one cannot generate copies of it or its value will inflate. This concept is called The Double Spend Problem by cryptographers because the same money is used in multiple transactions, which gives the illusion of money appearing from thin air. As per this issue, financial institutions and other intermediaries are utilized, creating an atmosphere of trust in the economy. Digital assets have centralized the process, making them more vulnerable to hackers [5]. Previously, there was no way of trusting a person on the other side of the computer screen, so these archaic intermediaries were logical. Currently, the blockchain can be used as a native medium for value instead of multiple different financial institutions. For the first time in generations, persons globally can know whether to trust each other and transact peer-to-peer. The isue that blockchain technology solves is trust over the internet [5].

The blockchain streamlines the transaction ecosystem by combining the payment and the settlement into the same activity. By using new age intermediaries, days or weeks can go by before money is transferred through a banking system across a city, while emails are capable of moving across the world in seconds [5]. Financial institutions assure a payment matches the settlement, or problems will be generated. The blockchain doesnt have this problem because only a single change is necessary for the global ledger, compared to requiring two matching changes on the payment and settlement side [5].

III. Project Requirements

The aim of this study is to analyze the feasibility of using blockchain technology to resolve the royalty matching problem in the music industry.

In 1897 Congress issued music producers the exclusive right to publicly perform their artistic work [16]. This act forced business entities to pay(royalties) for the public use of musical works. A new revenue stream was created for entertainers, it also created the difficult task of individually negotiating with each user for every use, or resolving every case of infringement. ASCAP, the first performance rights organization (PRO), was founded in 1914 to resolve this problem [16]. ASCAP job was created to addres the logistical matter of how to license, collect royalties for the public performance of musical works and distribute them fairly to the respective music creators [17].

PROs increased in number with the growing demand by musical creators, the need for a single entity to reconcile ownership and royalty disputes became more evident. Rightful owners did not receive payment when their music was played in public and when they did, it took an excruciating long time to process the transaction [18]. Many artists, music enthusiasts, scholars and technologists firmly believe that blockchain technology will resolve these issues. Will blockchain replace the performance rights organizations PROs? Should blockchain be the interface between the PROs and the customers? To find out:

1) The initial stage is to learn about the fundamentals of blockchain, how the technology works, as well as its advantages and limitations.
2) Learn about the ecosystem of royalties collection from businesses for music played
3) Analyze use cases and potential use case to determine whether or not blockchain may be the platform to improve the way royalty matching works

IV. Methodology

In determining the possible benefits and providing insight behind Blockchain technology is vital in providing a clear view. Examples of how the music industry system intertwines with artists signing their contracts, providing both a quantitative and qualitative approach to explain both perspectives further. The objective is to implement blockchain technology into the music industry, establishing new processes to ensure both the record companies and artists are getting what they deserve. Artists main issues is proper royalty payments and standardized direct method to track this activity.

The main issue with artists contracts is that third- party intermediaries oversee and control them [4]. A thorough research will be furnished about blockchain technology clarifying its impact on the music industry thus far. We have collected primary and secondary data from start-up companies that are currently incorporating blockchain into their business models,in addition displaying their specific business models and what blockchain technology has done for the company and artists on several platforms. Imogen Heap founded Mycelia, a blockchain ecosystem. Mycelia surrounds each song with a smart contract called The Creative Passport to protect each songs rights. This digital container empcompasses the following: verified profile information, IDs, acknowledgments, works, business partners and payment mechanisms for all music makers (creatives). It will become a digital identity standard for music makers, collectively forming the Creative Passport Database and evolving into the essential connective hub for all music related services. Using new blockchain technology, featuring smart template contracts, the Creative Passport will enable quick and easy direct payments, to simplify and democratize collaboration from meaningful commercial partnerships to creativity. Creative Passports will be free for music makers. Access to the Creative Passport Database will be a subscriber based service for businesses who wish to link in and take advantage of its precious data, or market their service to the Creative Passport holders. [5] Rapper, Mims, launched a blockchain company named RecordGram - a project aimed at helping producers and musicians to collaborate to create incredible music, and use blockchain to facilitate royalty payments. The system use a token called tune to record the digital rights of artists listed on its platform and to track their royalties. The system of RecordGram works

through a mobile app and allows both the musicians and producers to sign up for it. AS per the official website, users can not only create and save short audio clips and notes on the app but also share their creation with other members. Users can listen to music clips shared by other musicians. Tune token, licensed by RecordGram, was created with the primary motive of solving issues related to digital songwriter rights and transparency in royalty payments, which are widespread in the music industry. The platform is based on a blockchain so that the music created by musicians on the app remains immutable. These tokens can be converted to RecordGram credits any time, and can later be used to tip any artist or purchase music clips [19]. These are just two examples of the innovative approaches from artists to apply the development of blockchain technology to help certify the proper payments in the music industry.

These additions were sought to eliminate the confusion of royalty payments to musicians in the industry and provide a structure to follow. As per our research, we intend to be able to provide a clear understanding of not only the music industry, but the influence blockchain technology will have. The blockchain technology industry continues to evolve, allowing artists to learn more about it and use it to their advantage.

Spotify purchased blockchain company Mediachain, which was labeled as a "a peer-to-peer, decentralized database for sharing information across multiple applications and organizations." This acquisition was followed by a 43 million lawsuit over royalties Spotify failed to pay. The company said it didn't know who was supposed to receive the royalties. This acquisition was supposed to give it a new tool to help cut through the confusion of royalty distribution. Shortly after the acquisition, Spotify was again sued over unpaid royalties, this time for 1.6 billion. As founder of Mediachain, Jesse Walden explained: "Platforms like Spotify and SoundCloud have an incentive to find a reliable, long-term solution to the fractured data problem to avoid future lawsuits. Spotify seems to be leading the charge, having committed to 'fix the global problem of bad publishing data once and for all.'" This comment suggests Mediachain was not intended to supplant the current, dominant music delivery platforms. It instead offered a solution that could be utilized by those major players [20].

V. How it Works

Blockchain is a technology that was introduced by Bitcoin in 2008 and was used to create this decentralized crypotcurrency. The blockchain is a distributed ledger that keeps continuously updated digital records indicating ownership over digital assets. This ledger is unique in that its virtual, runs in the Cloud and underpins a network. More specifically, a blockchain is an incorruptible distributed ledger of data, which can be used to store informational assets ranging from

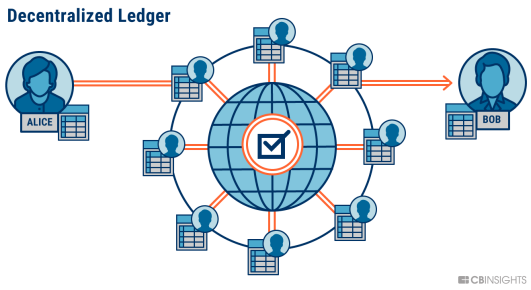

Fig. 2. In order for a transaction to be verified, the blockchain verifies that all assets are where they should be by checking the stored ledgers on multiple different computers on the blockchain [23].

managing cryptographic contracts to transferring value. A blockchain is a specific type of distributed ledger that uses cryptographic signatures to store data, or transactions, in chronologically ordered blocks attached, creating a chain. The relationship between the blockchain and Bitcoin is comparable to that of the Internet and Amazon - an electronic eco-system, on top of which you can build applications. Currency is just one component of the vast opportunities that Blockchain technology offers.

Instead of storing digital assets in a central location, an exact replica of each is kept in many independent locations, preventing the creation of a central point of failure [21]. Each transaction is posted in this shared ledger, which is synchronized across millions of computers throughout the world. This is made possible by the blockchain's ability to store the fingerprint of a specific digital asset, instead of the asset itself [22]. Due to the blockchain's scale, cryptocurrency miners require a massive amount of computing power. This computing power is about 10-100 times larger than Google's worldwide infrastructure. Every 10 minutes, a block is created containing all of the transactions from the previous 10 minutes. Each miner then begins to compete trying to solve tough problems. The first miner to validate the block is rewarded in that blockchain's respective digital currency. A Bitcoin is given on the Bitcoin blockchain; an Ether is provided on the Ethereum blockchain, etc. The more computing power that the miner has access to, the faster the miner will be able to validate the block. Each new block is linked to the previous block, which is connected to the last block, creating a chain of blocks. All blocks are time-stamped. If a hacker, for example, were to attempt to pay multiple people with the same money, the hacker would need to hack the block containing the transaction along with all previous blocks within that particular blockchain on millions of computers simultaneously. This is essentially the history of that blockchain [5].

VI. Current State and Potential issues facing Blockchain for digital music

A. Current State

Currently, there are multiple platforms using blockchain technology including but not limited to: Choon, Bittunes, Peertracks, Musicoin, and Voise. Some of these blockchain platforms are choosing to build their own systems in place while some are using ones that already exist [24]. Musicoin is one example using blockchain that allows consumers to stream their favorite music from different artists using the platform. Its a free platform that aims to provide a fair pay to artists creating music on their platform. Musicoin uses its own cryptocurrency and when a consumer wishes to compensate their favorite artist, they do so by using the Musicoin cryptocurrency. While Musicoin is still in its early stage, its mission is to increase the power of this currency so that it becomes the base of all economic activity around musical goods and services [**?**].

Choon is another interesting platform created by Gareth Emery. Its a digital publishing and distribution platform that allows artists to release their music with digital signatures attached. Each time a song is played, the blockchain is updated, and tracking plays is as simple as pulling up the public ledger. Consumers are always looking for new ways to stream music and help their preferred music artists. A recent study by Choon showed that 52 percent of consumers said they would use an alternative streaming music service if it rewarded artists more fairly. Seventy-six percent said theyd love to see their favorite musicians support themselves. Almost one-third of consumers, 31 percent, believe its wrong for organizations to part-own streaming services [25]. Most people arent familiar with how royalty payment works; some believe artists get paid the same day the music is streamed and others think within artists are paid within weeks. DJ Gareth Emery blasted streaming music companies by stating Streaming music is a huge driver of change in the music industry. With almost unlimited music on tap, consumers can listen to whatever they want."

B. Potential Issues

The problem with the streaming sites is they currently offer a terrible deal for artists. Artists have long complained about the low payouts on streaming services like Apple Music, where musicians earn 0.00783 per stream. To receive 1,472 US Dollars, considered to be the base wage for the service, artists need about 188,000 total plays. Spotify pays only 0.00397 per stream, while YouTube pays an even lower rate of 0.00074 per stream [25].

A current problem in the music industry is that thousands of existing centralized databases have little to no interoperability, meaning information cannot synchronize between databases when one of them is updated. The updates go unnoticed by the other databases. Another problem is the lack of a standard file format. Two file type examples are .MP3 files and .WAV files. If we were to place audio in a standardized format, we would synchronize audio files, ownership rights, meta-data, and licensing information. [6]

From 2015 to 2018, crypto coins have been a roughly $12 billion industry. In general, digital music platforms pay 70% of their revenue to rights-holders and creators. A large number of stakeholders in this asset make it challenging to distribute wealth. With blockchain technology, each of these people can quickly and easily be paid the micro pennies they're owed each time their content is purchased. Streaming companies take 30% due to this being such a tedious process. A user could rip a song from YouTube, rename it, add their artwork within iTunes and call it their own. It's not possible for iTunes to search and verify ownership of these files. There is no one place, public or private, to look up purchase information of songs. The blockchain can provide this functionality, resulting in fewer ownership disputes [6] A music industry owned format would be created that enables tracking, communication, and monetizing of media files. All of this is done through the blockchain. The blockchain is the synchronizing agent between clients. DotBlockchain founder Benji Rogers, speaks about his upcoming product. Songs posted on DotBlockchainMusic can be given a dashboard used for functions such as receiving requests, messages from Spotify, song verification, artist verification, third-party apps like Slack or Whats-App, and even version history. Artists can be communicated with directly through this dashboard as well. Each song can be individually commented on. "For the first time in history, there is more money to be made over the table, than under the table."It makes things much more comfortable and more streamlined. Benji Rogers believes that modern music services will need to be built on top of the blockchain. Artists and creators will be able to control their destiny [6].

1) Complexity: Blockchain technology involves an entirely new vocabulary. It has made cryptography more mainstream but most consumers don't understand what blockchain is. The problem is most companies' business model is based on the principle that people believe artists need fair payout for their creativity. These companies are based on the blockchain model and are not providing enough information to the public to help adopt the technology.

2) Low Perceived Asset Value: Blockchain technology usually allows the transfer of a cryptocurrency such as Bitcoin. Musicoin, as well as other companies that are bringing blockchain technology to the music industry, are creating their own cryptocurrency. There is usually a problem with artists in the perceived value of that

cryptocurrency. The currency's value may go up, but it may also go down at any moment in time. With that in mind, artists may have doubts in using the blockchain platform to distribute their music.

3) Resistance of Intermediaries: Since blockchain promotes the idea of removing the intermediary, those with the most power in the music industry are likely to resist it. O'Dair states "Transparency throughout the value chain may be in the interests of artists, but intermediaries may benefit from the opacity of data currently provided to artists" [26]

4) Attribution of Work: Attributing work to an artist has been a major problem in the music industry. Adopting blockchain technology in the music industry will prompt companies to find solutions mitigate the problem. Currently, there are computer algorithms that create a hash function to attribute a music piece to an artist [26].

VII. Can Blockchain Help?

Blockchain technology has a very high potential to be the medium for performing digital transactions for the music industry. Costs are reduced to a minimum, and only two parties are necessary. Blockchain can also provide a digital audit trail of transactions and can be used to verify the integrity of data cheaply and securely due to the decentralized nature of stored data. It can help businesses and individuals agree, on a global scale, about the true state of affairs within a market without relying on a costly intermediary [27]. This is achieved through a clever combination of economic incentives and cryptography. This ensures that at any point in time, digital records reflect the true "consensus among the key stakeholders involved. When it comes to sharing digital records and assets, it can, therefore, replace the need for trust between players, or the need for a central authority to verify and maintain the records of transactions. The studys goal is to use the distributed ledger technology as a platform for hosting immutable meta-data about songs, the artists who recorded them, and who is listening to them and ultimately enabling peer to peer value exchange as well as restoring more equity in songs to the artists, engineers, and producers who made them. Early efforts have not yet been major financial successes, but they are a proof of concept [28].

VIII. Future Works

Blockchain has been one of the most highly regarded technology innovations since its inception. There are currently many benefits to it adoption in the music industry including but not limited to, transparency, instant payments, attribution of work, and removal of the intermediary. These are especially important for the music artists as they are affected by these factors the most. While it's still in its early stage in the music industry, several blockchain companies such as Coon, Musicoin, and Peertracks have already started in attempting to use the technology to help music artists distribute their music. If these companies provide are able to provide a secure, reliable, and effective way of distributing music with a value exchange, independent and mainstream artists may make it more popular and may pave the way for new artists to start using the available or emerging platforms. If blockchain platforms in the music industry were to provide more incentives to the intermediaries to adopt the technology, though challenging, would speed up the process in its adoption into the mainstream. It is therefore, likely that it will be popularized in the music industry through other means that are not entirely clear yet. There is a huge potential for blockchain in the music industry to become popular and adopted in the future by many independent artists since there's a lack of transparency, authorship, and pay within the music industry.

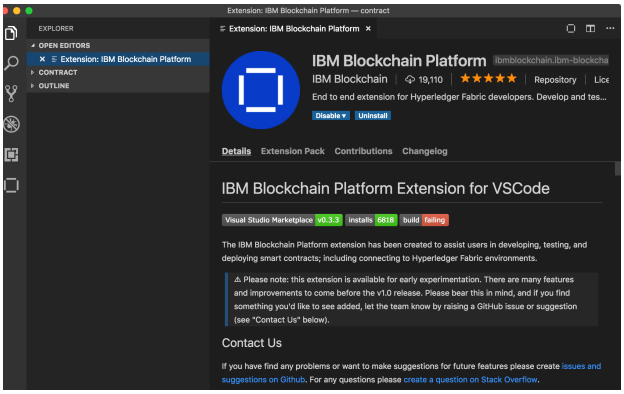

Fig. 3. Music Blockchain Initialization of Contract After Agreement

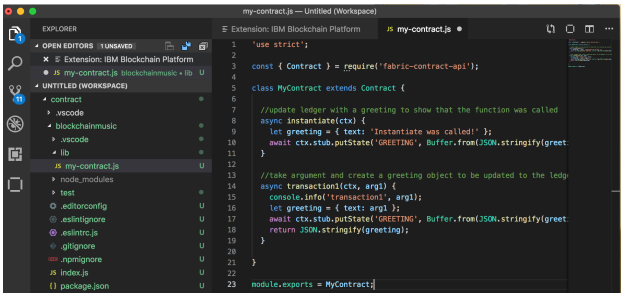

Fig. 4. Music Blockchain Contract

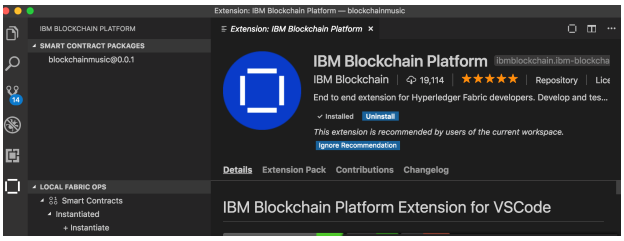

Fig. 5. Smart Contract Created

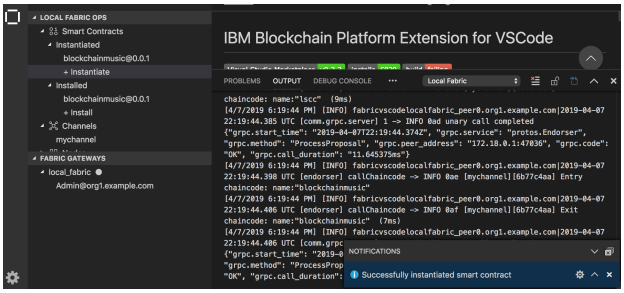

Fig. 6. Successful Instantiate Local Peer to IBM Hyper Fabric Network

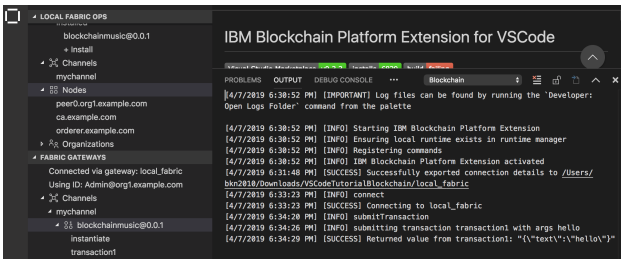

Fig. 7. Successful Transmission Submission Fabric Network

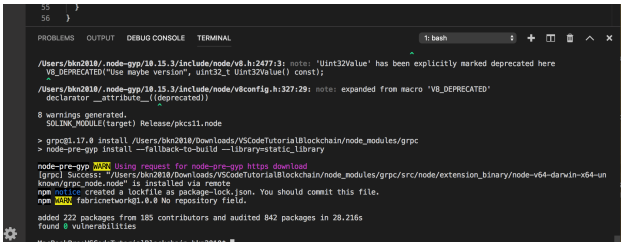

Fig. 8. Installing Ledger Code

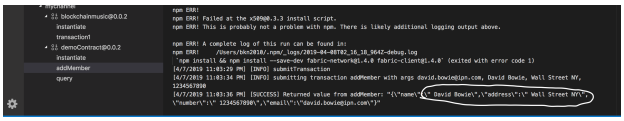

Fig. 9. Artist Entry via Ledger David Bowie

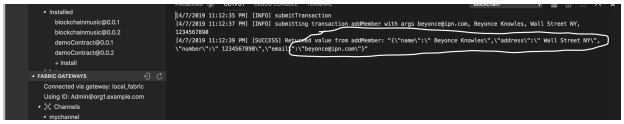

Fig. 10. Artist Entry via Ledger - Beyonce Knowles

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