Blockchain in Music Industry

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***Abstract*- The music industry is in crisis, outpaced by the digital revolution and unwilling to innovate and adapt. With all but the top-earning musicians struggling to get paid, the promise of a new technology that could support artists at both ends of scale seems almost too good to be true. Improving the existing Music Industry with Block Chain Technology by having a Decentralized Database to store the copyrights information where the information on the blockchain would be updated instantly and automatically thereby making the same available to all the users. This decentralize database ensures that once the copyright information for a music file is created it cannot be altered or reversed. Irrespective of the number of times the music files is distributed the true ownership will never change thereby removing black boxes in music industry and ensuring a fair trade and payment.**

I. INTRODUCTION OF BLOCKCHAIN TECHNOLOGY

The music industries are worth an estimated $45 billion globally, of which the record industry – those aspects associated with recorded music – is responsible for approximately $15 billion (Rethink Music 2015). 2015 marked an overall increase in income from recorded music of 3.2%, yet this can be seen as a cause for optimism only in the context of two decades of apparently inexorable decline (IFPI 2016). Though the era of legal downloads and, more recently, streaming may in some respects seem an improvement on the initial 'piracy' era of digital consumption (Watson 2015), the shift to a model based on access rather than ownership has brought with it significant challenges. The entire blockchain is retained on this large network of computers, meaning that no one person has control over its history. That's an important component, because it certifies everything that has happened in the chain prior, and it means that no one person can go back and change things. It makes blockchain a public ledger that stores the data maintaining transparency and uses peer to peer network to send or pass any kind of information between others.

While traditionally we have needed these central authorities to trust one another, and fulfil the needs of contracts, the blockchain makes it possible to have our peers guarantee that for us in an automated, secure fashion.

II. TERMINOLOGY

1.Playground: Browser UI to edit and test the business networks. It can be set up on local machine or on cloud

2.Command Line Interface(CLI) Tools: Responsible for execution of the composer functions

3.Rest API: Exposes the blockchain logic to web applications.

4.Hyperledger Composer: Used to define and deploy business network applications.

5.The REST Server: Based on LoopBack technology converts the Composer model for a business network into an Open API definition, and at runtime implements Create, Read, Update and Delete support for assets and participants and allows transactions to be submitted for processing or retrieved.

6.Hyperledger Fabric: A platform for distributed ledger solutions with a modular architecture delivering high degrees of confidentiality, resiliency, flexibility and scalability. It allows components such as consensus and membership services, to be plug-and-play.

7.Cryptocurrency: A digital currency whose security is guaranteed through the use of cryptography

8.Transaction: The transfer of coins from an address (or addresses) to another address (or addresses). An address is the public representation of the public and private key pairs that are used to store and transfer coins. It is used to send and receive funds

9.Smart contract: A contractual agreement built on computer protocols, whose terms can be executed automatically

10.Ethereum: A blockchain that runs smart contracts using its own cryptocurrency, ether

11.Proof of work: A method of achieving network consensus, whereby the ability to mine coins is dependent on the computing power of the miner

12.Permissioned blockchain: A blockchain whose use is restricted to known, vetted participants

13.Permission-less blockchain: A blockchain that is accessible to anyone who wishes to use it

14.Public blockchain: A blockchain that grants read access and ability to create transactions to all users

15.Private blockchain: A blockchain that limits read access to particular users

16.Mining: Best thought of as nodes or bookkeepers, miners compete to solve a mathematical puzzle that requires the consumption of computing power (see 'proof of work'). Once the puzzle is solved, the new block of transactions is accepted by the network and committed to the blockchain. The miner is rewarded with newly generated coins

17.Ether: The cryptocurrency used on the Ethereum blockchain

18.Seed funding: Relatively small investment required to start a business, typically from friends, family or angel investors

19.Private key: A means of digitally signing transactions. Randomly generated, it must be kept secret as private keys facilitate the spending of coins stored in the associated address

20.Wallet: Software that holds addresses and their associated keys, and which provides the ability to send and receive coins

III. WORKING OF BLOCKCHAIN

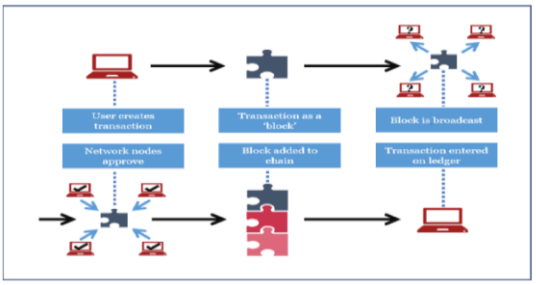


Fig 1. Working of Blockchain

Blockchain is the digital and decentralized ledger that records all transactions. Every time someone buys digital coins on a decentralized exchange, sells coins, transfers coins, or buys a good or service with virtual coins, a ledger records that transaction, often in an encrypted fashion, to protect it from cybercriminals. These transactions are also recorded and processed without a trusted third-party provider, which is usually a bank, paper money in your pocket, government, to avoid intermediary commission during a financial transaction. Transactions are verified by miners who maintain the ledger. Miners are people or organizations with powerful specialized computers who compete to solve difficult computations using proof of work mechanism.

Traditional-Although blockchain technology has only been effectively employed in the past decade, its roots can be traced back far further. A 1976 paper on New Directions in Cryptography discussed the idea of a mutual distributed ledger, which is what the blockchain effectively acts as. That was later built upon in the 1990s with a paper entitled How to Time-Stamp a Digital Document. It would take another few decades and the combination of powerful modern computers, with the clever implementation with a cryptocurrency to make these ideas viable. In order to validate the blocks in the same manner as a traditional private ledger, the blockchain employs complicated calculations. That, in turn, requires powerful computers, which are expensive to own, operate, and keep cool.

IV. ADVANTAGES

Contracts, transactions, and the records of them have long played a crucial role in our modern world. Our legal and political systems rely on contracts and transactions for virtually every core function.

Contracts, transactions, and records are used to protect assets or set organizational boundaries. They're used to verify identities or chronicle events. Every day, the world around us is governed by contracts and transactions. However, the way in which we record these contracts and transactions is stuck in the past. These critical tools have not kept up with the digital

revolution. There are many companies which are seeking to implement blockchain technology into various industries – the potential benefits are enormous. There's enormous hype in the world of blockchain right now. Blockchain startups are springing up every day. With a change as substantial as blockchain technology, countless modern institutions would need to fall before blockchain could fully be implemented.

V. DISADVANTAGES

Transaction speed is also an issue. Blocks in a chain must be verified by the distributed network, and that can take time. A lot of time. At its worse, bitcoin's average transaction time exceeded 41 *hours*. Processing rate of the transactions per block is less. Prior Knowledge required. Node participation possible but not the node elimination. Ethereum is much more efficient, but its average time is around 15 seconds — which would be an eternity in a checkout line at your local grocery store. Blockchains used for purposes other than cryptocurrency could run into similar problems. You can imagine how frustrating it would be to wait 15 seconds every time you wanted to change a database entry.

VI. FEATURES:

a) Decentralization:

One of the key features of this technology is that it's a distributed database. It's decentralized. The database exists in multiple copies across multiple computers. Each of these copies is identical. The computers – or nodes – all form a peer-to-per network, which means there's no centralized database or server.

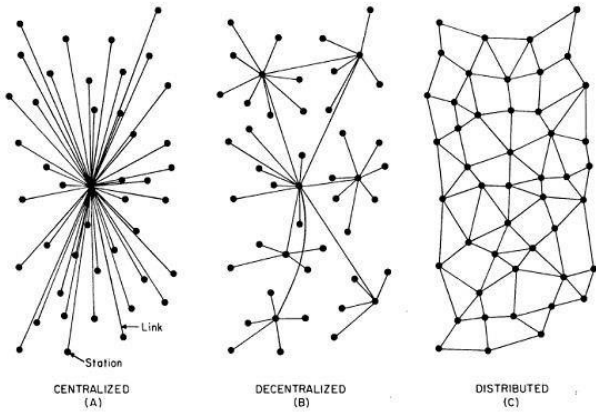


Fig 2. Different Networks

Today, organizations maintain centralized databases and servers where all their data is held. This makes these servers a lucrative target for hackers. Blockchain decentralizes data and makes it public but encrypted. Many people believe this makes it tamper-proof. When a transaction occurs on the blockchain, data about that new transaction must be sent to all computers – nodes – on the network. This means the blockchain stays in sync as one "world wide ledger". Instead of having multiple conflicting ledgers, there's a single version of "the truth".

b) Digital signatures

Another key feature of blockchain is that each transaction on the blockchain is signed digitally, using public key cryptography. Public key cryptography involves the use of two keys – a public and private key. The public key is used to sign and encrypt the sent message, and anyone can see this key. However, only the recipient has the private key, which means only the recipient can decrypt the transaction. Public keys are used for more than just encrypting messages: they're also used to authenticate an identity.

c) Blocks Of Transactions

The reason it's called a blockchain is because it's literally a chain of blocks.

Each block in the blockchain consists of a list of transactions. Each block also contains a block header. Headers contain three sets of metadata, including structured data about the transactions in the block; a timestamp and proof-of-work algorithm data; and a reference to the parent block, or previous block, using a hash. Using these three sets of metadata, each block is chained together – hence the word blockchain.

d) Mining

Mining is the process by which new blocks are created on the blockchain. In Bitcoin, a new block is mined every 10 minutes. Some cryptocurrencies have a faster block transaction time, while others have a slower time. Essentially, this means that a Bitcoin transaction takes a maximum of 10 minutes to process.

Mining validates each new transaction on the blockchain. In order to do that, the miner (which is a computer or processor) solves a unique, difficult math puzzle. These puzzles require enormous computational power.

To put the computational power into perspective, miners were tracked trying 450 thousand trillion solutions per second to solve the puzzles – and that was all the way back in October 2015 as reported by The Economist.

e) Public vs. Private Blockchains

People within the industry talk a lot about public versus private blockchains. On a basic level, public blockchains enables peer-to-peer transactions and, therefore, a revolution in seamless global payments. Interacting with public blockchains fundamentally requires tokens, and comes with its own rules of engagement, agreed upon by the P2P network.

Private blockchains (those being built by distributed ledger consortium R3, for example) use blockchain-based application development platforms such as Ethereum or blockchain-as-a-service (BaaS) platforms such as those offered by Microsoft and IBM, running on private cloud infrastructure.

Brian Forde, Director of Digital Currency at the MIT Media Lab, likens public versus private blockchains to the relationship between an open-source technology, such as Linux, and companies like Red Hat that build on that tech for enterprise use. Public blockchains like Bitcoin were the open-source movement that started it all, and private blockchains such as R3 are taking that technology and commercializing it for businesses.

"Some of the other blockchain networks, whether it's [open-source project] Hyperledger, Ethereum, or a bank chain [such as R3] are opening the question of trust and trust shifting, "It's less about the technology, and much more about a rapid, near real-time adjudication of rules between actors on a network.

VII. INNOVATIONS & APPLICATIONS:

There have been a number of innovations over the history of blockchain. Without these innovations, blockchain technology wouldn't be nearly as useful as it is today. Those innovations include all of the following:

1. Bitcoin- By nature, this is the first and most obvious blockchain innovation

2. Blockchain:

The second innovation is when people realized that the underlying technology behind bitcoin – the blockchain – could be used for more than just bitcoin.
People realized it could be used for other cryptocurrencies, for example, or for a wide range of other industries and purposes. This is where the history of blockchain technology and innovation really took off.

3. Ethereum & The Smart Contract:

The second major blockchain platform after Bitcoin was the Ethereum blockchain. The primary advantage of the Ethereum blockchain over previous blockchains was the smart contract system.
Essentially, this involved building small computer programs directly in the blockchain. This allowed conventional financial tools – like loans or bonds – to be represented on the blockchain, instead of just bitcoins and cryptocurrencies.

4. Proof Of Stake:

Proof of stake started appearing in late 2016 and early 2017. Today, most blockchains are secured by Proof of Work, which means the group with the largest computing power makes the decisions (i.e., the miners with the biggest share). New blockchain technology replaces this with proof of stake. This is a key security innovation because it removes one of the only security flaws in traditional blockchains – the fact that miners with a 51% share of processing power could take control of bitcoin or other cryptocurrencies.

5. Scaling:

Scaled blockchain technology will accelerate blockchain processing in the future. Today, blockchain technology requires every computer in the network to process every transaction. This is slow and inefficient. Scaled blockchain technology will accelerate the process by determining the precise number of computers needed to process each transaction, and then utilizing other computers for other tasks.
Ultimately, the history of bitcoin is a history of the world's elite computer scientists pushing computer and internet technology past their known limits. And all of this innovation can be traced back to Satoshi Nakamoto.
Some current uses of Blockchain include Ride Sharing, Smart-contracts, e-healthcare, Finance, Shipping & Gaming.

VIII. MUSIC INDUSTRY TRADITIONAL METHOD

The traditional music industry has few disadvantages and could be made much better through Blockchain Technologies.

a) Large centrally controlled database

The large central controlled database has lot of problems as changes to a system cannot be made automatic and simultaneous. The error detection also becomes difficult

b) Sends music files and metadata separately via third parties. Each time a data is sent a third party is involved thereby making it a complex system
c) Message multiple parties to songs in separate places
d) Music files, contracts, artwork & metadata all in separate places
Changes cannot be made simultaneous.
e) No single agreed-upon identity or authority system
Lack of clear authority deters the system efficiency.

IX. OUR APPROACH

To implement Blockchain Technology in Music industries where the copyright information is stored in Decentralized database. It uses a Network Database for Music copyright information. The system can define the access rules thereby making it available to all users simultaneously. Any updates in the database will automatically get updated. Distribution happens through a copy of original document hence the soul authority power is preserved.

X. TOOLS PRESENT

As you can see, there are Blockchain technology-based frameworks/products in each block. There is no "one technology fits all" solution. Different development platforms come with different benefits and different learning curves. I would be explaining some of them here,
1.Ethereum: Ethereum is not only a centralized database of information where one can trade in Ethers. It is also a development framework where one can realize a lot of wonderful ideas and implement them using a Blockchain. The most important aspect of Ethereum Blockchain Development is a concept called Smart Contracts. Smart contracts are basically simple methods or functions which run on the Ethereum Blockchain. They can be imagined as something similar to a Java function for instance. But the difference is that every time the Smart Contracts are executed, the execution takes place over the Blockchain and it is written forever in form of a transaction

A lot of Blockchain developers are developing Smart contracts. Smart contracts are written in Solidity. According to the introduction, Solidity is a contract-oriented, high-level language for implementing smart contracts. It was influenced by C++, Python and JavaScript and is designed to target the Ethereum Virtual Machine (EVM).

2.Hyperledger

Hyperledger is a Business Blockchain tool developed by Linux foundation and IBM. It provides the capability to create a private permissioned Blockchain. A good point to start learning Blockchain development using Hyperledger would be this.

	Ethereum	Hyperledger
Cryptocurrency	Ether, user-created cryptocurrencies	None
Network	Public or Permissioned	Permissioned
Transactions	Anonymous or private	Public or confidential
Consensus	Proof of work	Practical Byzantine's Failure
Smart Contracts (business logic)	Yes (Solidity, Serpent, LLL)	Yes (Chaincode)
Language	Golang, C++, Python	Golang, Java

Fig 3. Difference between Ethereum and Hyperledger

XI. PLATFORM:

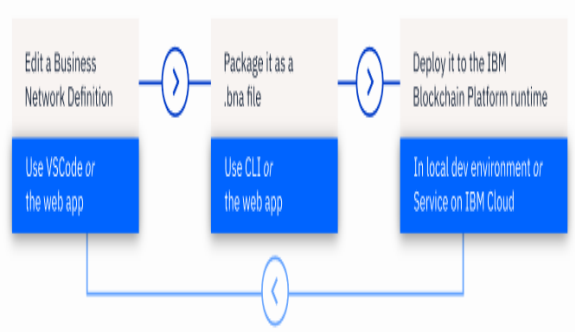


Fig 4. Workflow Of IBM Blockchain

The IBM Blockchain Platform makes use of the most prevalent and popular open source Blockchain technologies and is a big supporter and contributor to OS projects. All transactions submitted through a business network are stored on the blockchain ledger, and the current state of assets and participants are stored in the blockchain state database. The

blockchain distributes the ledger and the state database across a set of peers and ensures that updates to the ledger and state database are consistent across all peers using a consensus algorithm.

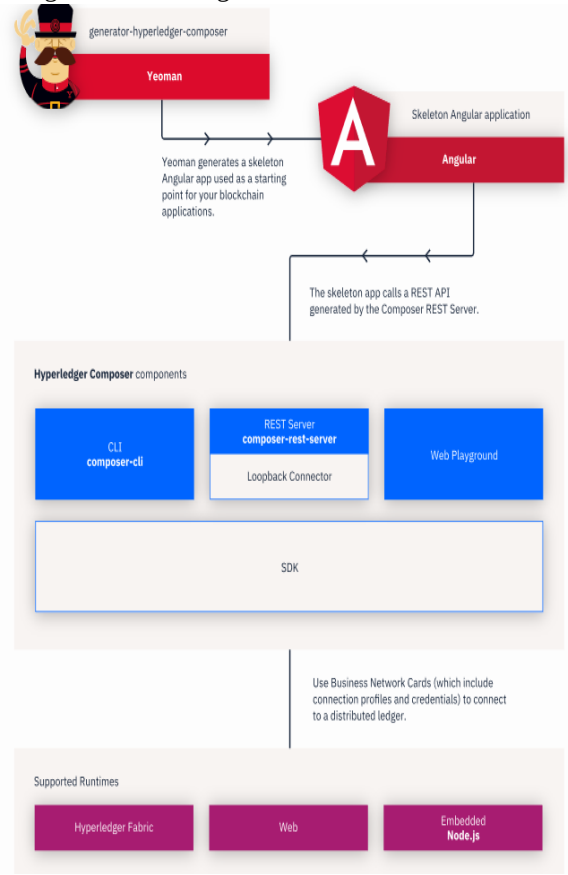


Fig 5. Component Description of IBM Blockchain

IBM Blockchain Platform: Develop is composed of the following high-level components:

1. Execution Runtimes (four are currently supported!): IBM Blockchain Platform: Develop has been designed to support different pluggable runtimes, and currently has three runtime implementations: . * Hyperledger Fabric version 1.0. State is stored on the distributed ledger. * Web, which executes within a web page, and is used by Playground. State is stored in browser local storage. * Embedded, which executes within a Node.js process, and is used primarily for unit testing business logic. State is stored in an in-memory key-value store.
2. JavaScript SDK: The IBM Blockchain Platform: Develop JavaScript SDK is a set of Node.js APIs the enables developers to create applications to manage and interact with deployed business networks.

The APIs are split between two npm modules:

   a. composer-client used to submit transactions to a business network or to perform Create, Read, Update, Delete operations on assets and participants
   b. composer-admin used to manage business networks (deploy, undeploy)

3. Command Line Interface: The composer command line tool enables developers and administrators to deploy and managed business network definitions.
4. REST Server: The IBM Blockchain Platform: Develop REST Server automatically generates a Open API (Swagger) REST API for a business network. The REST Server (based on LoopBack technology) converts the Blockchain Platform model for a business network into an Open API definition, and at runtime implements Create, Read, Update and Delete support for assets and participants and allows transactions to be submitted for processing or retrieved.
5. LoopBack Connector: The IBM Blockchain Platform: Develop LoopBack Connector is used by the Blockchain Platform REST Server, however it may also be used standalone by integration tools that support LoopBack natively. Alternatively it may be used with the LoopBack tools to create more sophisticated customizations of the REST APIs.
6. Playground Web User Interface: IBM Blockchain Platform: Develop Playground is a web user interface to define and test business networks. It allows a business analyst to quickly import samples and prototype business logic that executes on the Web or Hyperledger Fabric runtime.
7. Develop uses Connection Profiles to connect to a runtime. A Connection Profile is a JSON document that lives in the user's home directory (or may come from an environment variable) and is referenced by name when using the Blockchain Platform APIs or the Command Line tools. Using connection profiles ensures that code and scripts are

easily portable from one runtime instance to another.

8. Yeoman code generator: Develop uses the Open Source Yeoman code generator framework to create skeleton projects:
    a. Angular web application
    b. Node.js application
    c. Skeleton business network
9. VSCode and Atom editor plugins: Develop has community contributed editor extensions for VSCode and Atom. The VSCode extension is very powerful and validates Blockchain Platform model and ACL files, providing syntax highlighting, error detection and snippets support. The Atom plugin is much more rudimentary and only has basic syntax highlighting.

XII. HYPERLEDGER TOOL

IBM Blockchain Platform: Develop is an extensive, open development toolset and framework to make developing blockchain applications easier. The primary goal is to accelerate time to value and make it easier to integrate your blockchain applications with the existing business systems. Blockchain Platform is used to rapidly develop use cases and deploy a blockchain solution in weeks rather than months. Blockchain Platform allows you to model your business network and integrate existing systems and data with your blockchain applications. It supports the existing Hyperledger Fabric blockchain infrastructure and runtime, which supports pluggable blockchain consensus protocols to ensure that transactions are validated according to policy by the designated business network participants. Everyday applications can consume the data from business networks, providing end users with simple and controlled access points. Used to quickly model your current business network, containing your existing assets and the transactions related to them; assets are tangible or intangible goods, services, or property. As part of the business network model, define transactions which can interact with assets. Business networks also include the participants who interact with them, each of which can be associated with a unique. All transactions submitted through a business network are stored on the blockchain ledger, and the current state of assets and participants are stored in the blockchain state database. The blockchain distributes the ledger and the state database across a set of peers and ensures that updates to the ledger and state database are consistent across all peers using a consensus algorithm.

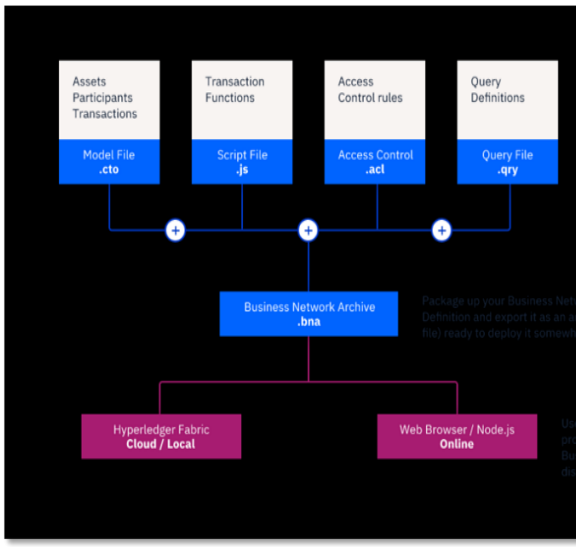


Fig 6. Business Network Architecture

a) Assets

Assets are tangible or intangible goods, services, or property, and are stored in registries. Assets can represent almost anything in a business network, for example, a house for sale, the sale listing, the land registry certificate for that house, and the insurance documents for that house may all be assets in one or more business networks. Assets must have a unique identifier, but other than that, they can contain whatever properties you define. Assets may be related to other assets or participants.

Our Application: Asset=Music Document

b) Participants

Participants are members of a business network. They may own assets and submit transactions. Participant types are modeled, and like assets, must have an identifier and can have any other properties as required.

Our Application: Participants=Seller & Buyer/
Entities trading the music documents

c) Identities and ID cards

Within a business network, participants can be associated with an identity. ID cards are a combination of an identity, a connection profile, and metadata. ID cards simplify the process of connecting to a business network and extend the concept of an identity outside the business network to a 'wallet' of identities, each

associated with a specific business network and connection profile.
Our Application: A json file named connection profile

d) Transactions

Transactions are the mechanism by which participants interact with assets. This could be as simple as a participant placing a bid on a asset in an auction, or an auctioneer marking an auction closed, automatically transferring ownership of the asset to the highest bidder.
Our Application: Transferring the ownership and remove extra music files

e) Queries

Queries are used to return data about the blockchain world-state. Queries are defined within a business network and can include variable parameters for simple customization. By using queries, data can be easily extracted from your blockchain network. Queries are sent by using the IBM Blockchain Platform: Develop API.
Our Application: Query files includes queries like select all music documents, select music documents by owner, exchange etc.

f) Events

Events are defined in the business network definition in the same way as assets or participants. Once events have been defined, they can be emitted by transaction processor functions to indicate to external systems that something of importance has happened to the ledger. Applications can subscribe to emitted events through the `composer-client` API.

g) Access Control

Business networks may contain a set of access control rules. Access control rules allow fine-grained control over what participants have access to what assets in the business network and under what conditions. The access control language is rich enough to capture sophisticated conditions declaratively, such as "only the owner of a vehicle can transfer ownership of the vehicle". Externalizing access control from transaction processor function logic makes it easier to inspect, debug, develop and maintain.
Our Application: permissions.acl

h) Historian Registry

The historian is a specialized registry which records successful transactions, including the participants and identities that submitted them. The historian stores transactions as Historian Record assets, which are defined in the IBM Blockchain Platform: Develop system namespace.

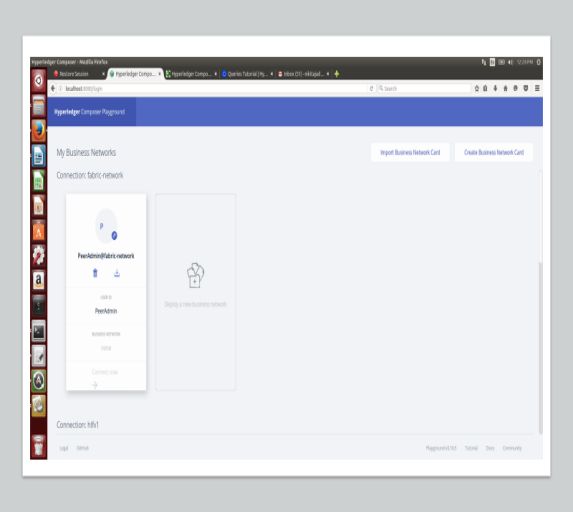
XIII. SYSTEMATIC PROCEDURE

Following are the steps to follow:

1. Go for Ubuntu Linux 14.04/16.04 LTS
2. Installing the prerequisites:
    - Docker Engine: Version 17.03 or higher
    - Docker Compose: Version 1.8
    - Node: 8.9 or higher
    - Npm
    - Git
    - Python
    - VSCode Editor
3. Installing the development tools:
    - CLI
    - Configure the playground
    - Setup the VSCode
    - HyperLedger Fabric
4. Deploying to Hyperledger fabric
    - Start the Hyperledger fabric runtime
    - Build the connection profile
    - Locate the certificate and private key of the Hyperledger fabric admin
    - Create a business network for this admin
5. Setup the development network
    - Creation of skeleton business network
    - Defining the business network
6. Generate the business network archive (bna) file
7. Deploying the application on the REST Server
8. Testing the connection to the blockchain business network.

XIV. EXPERIMENTAL RESULTS:

Fig 7.a: Configuring the composer playground to run our network(mini-network) along with other peers



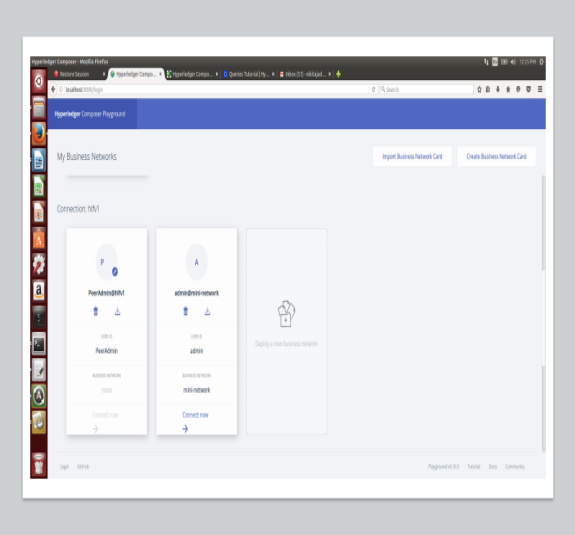
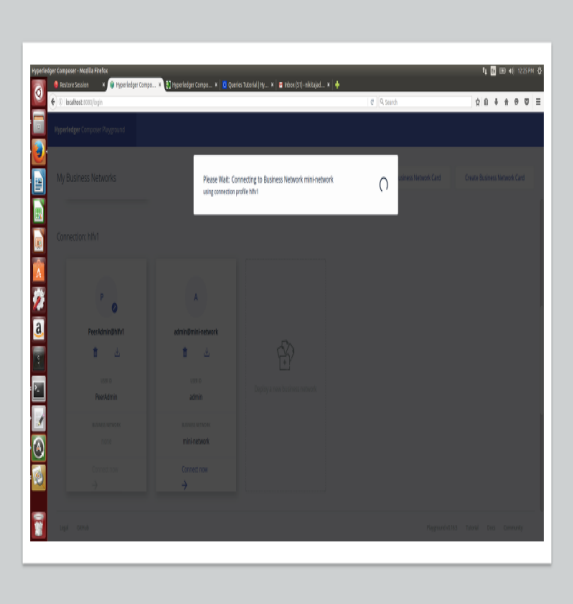


Fig 7.b: Model File consisting of the assets, participants & the transaction



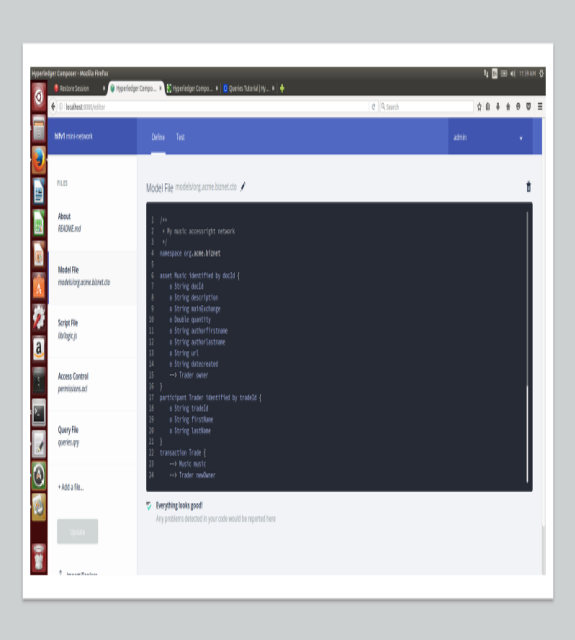


Fig 7.c: Transaction logic for the trading the music documents along with the copyright information

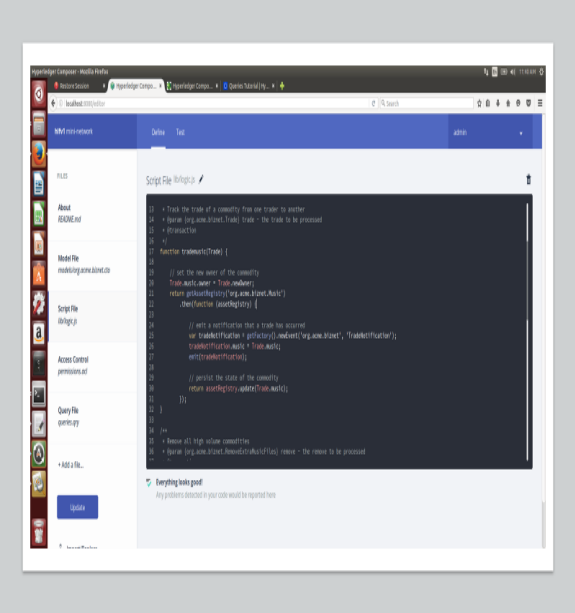


Fig 7.d: Each owner possesses only 1 music file unique with the copyright information

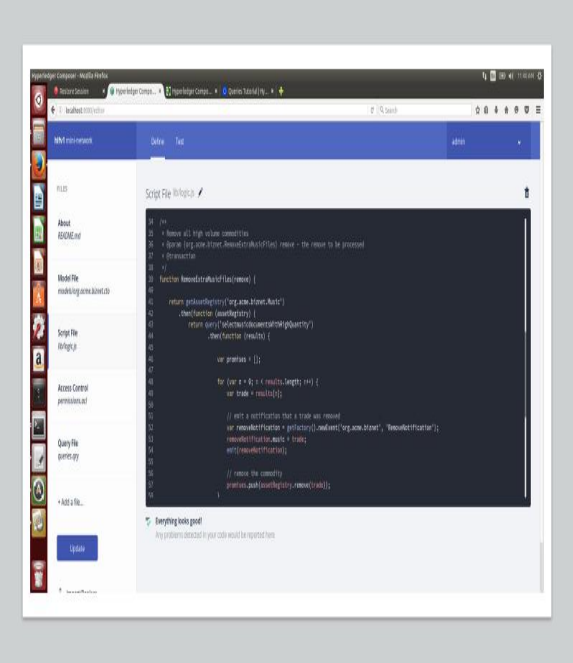


Fig 7.e: In case of any changes updating the bna file with the command as

- Composer archive create –sourceType dir –sourceName . -a mini-network@0.0.1.bna
- Composer network update -a mini-network@0.0.1.bna -c admin@mini-network

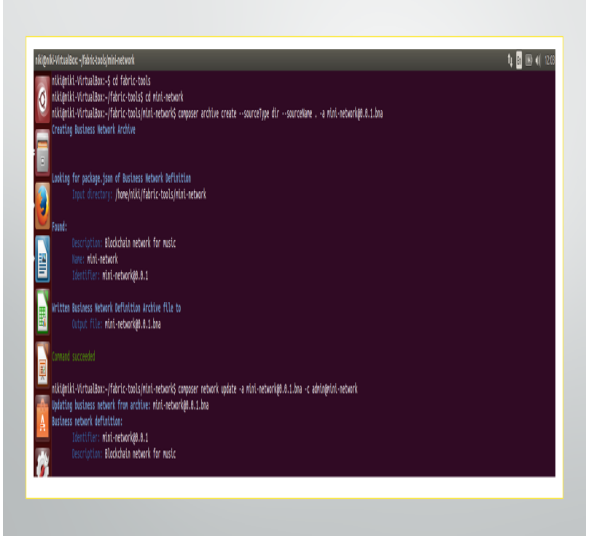


Fig 7.f: Querying the model & transaction file

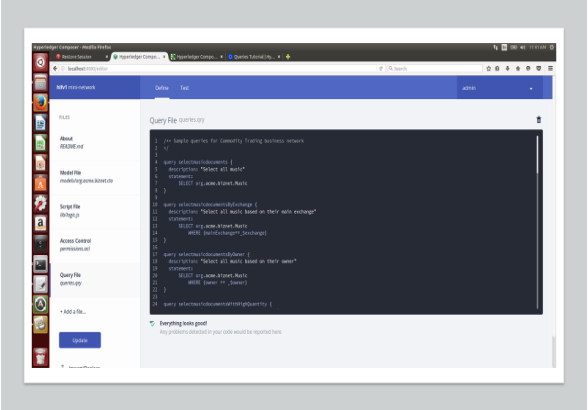


Fig 7.g: Access Control File assigns the permissions to the traders

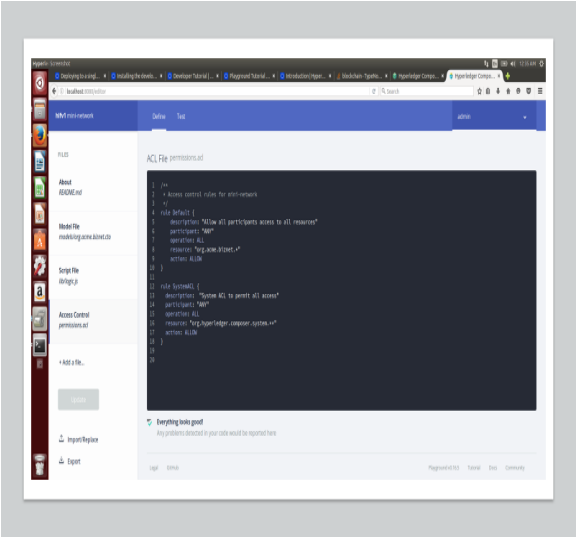
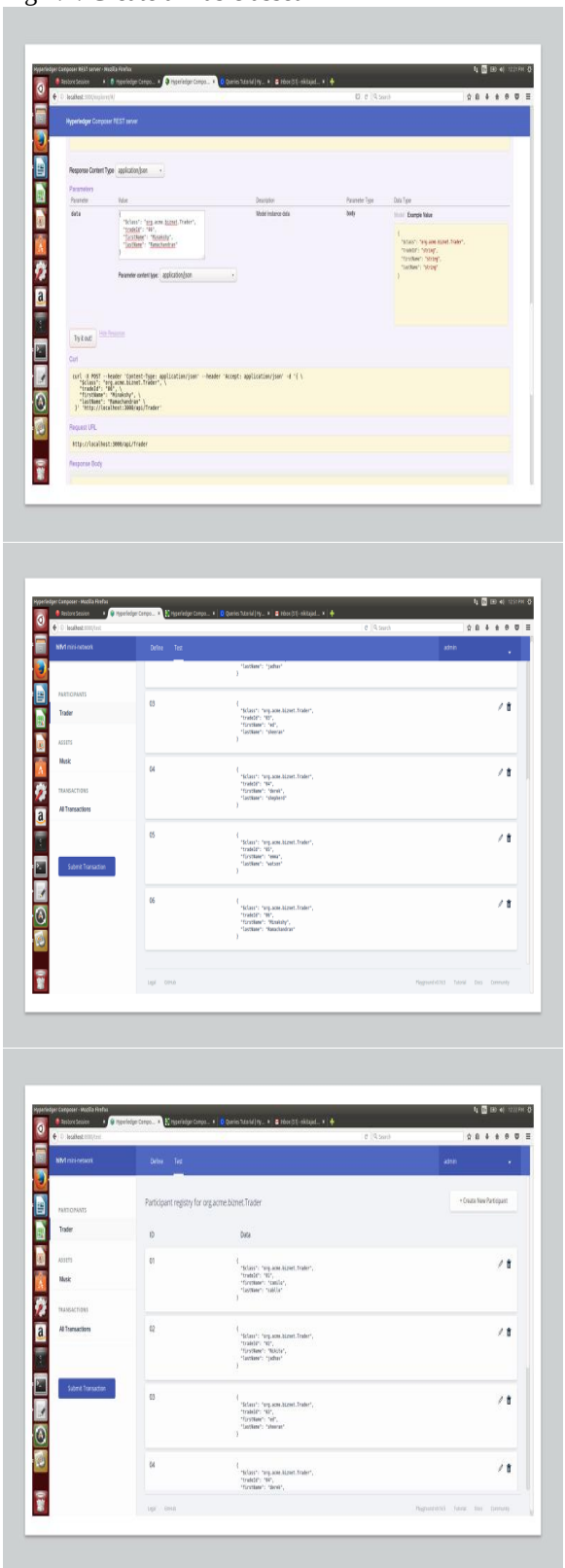


Fig 7.h: Create a music asset



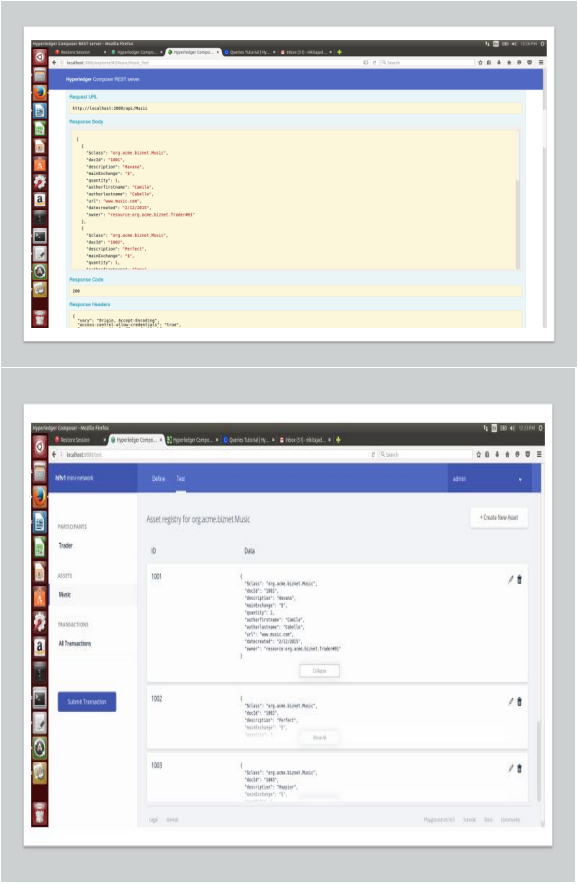


Fig 7.i: Create a music asset on the hyperledger fabric platform

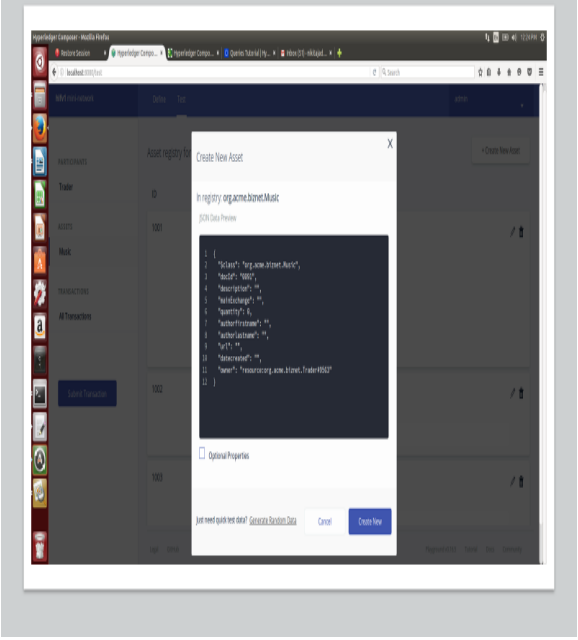


Fig 7.j: This screenshot contains the music asset with ID 1004 with more than 1 file so we aim in removing it.

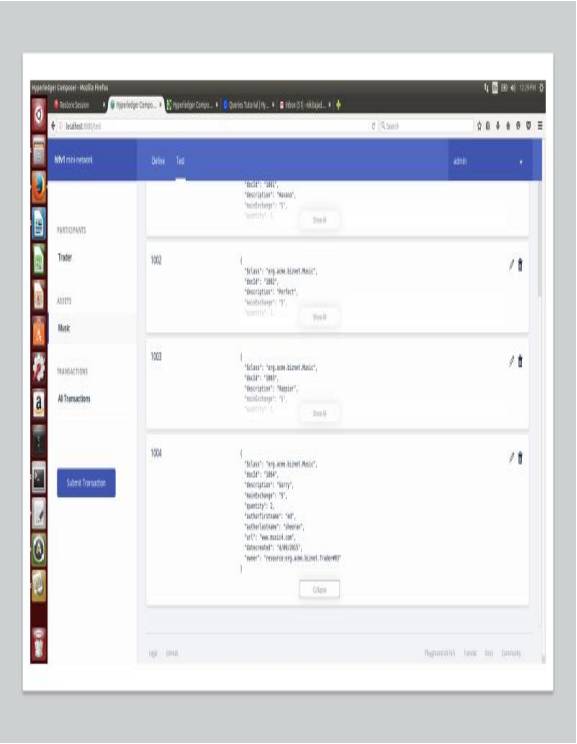


Fig 7.k: Here on the composer playground we eliminate those extra music files

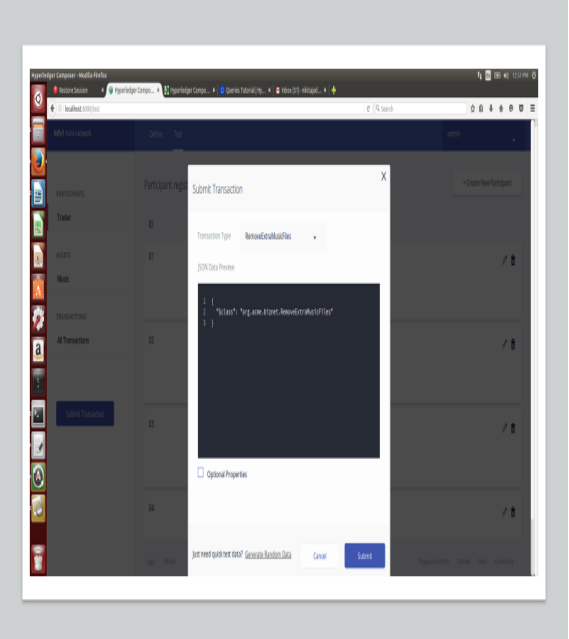


Fig 7.l: The document is hashed to prevent irreversible transaction & corresponding transaction ID is generated.

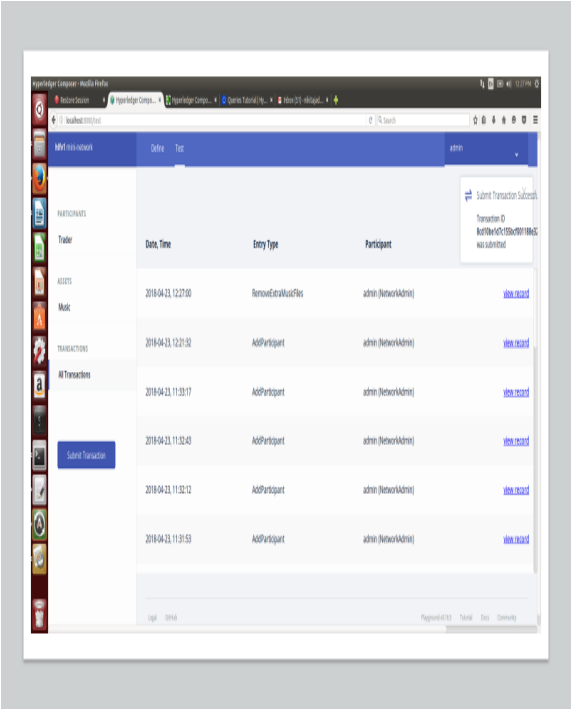


Fig 7.m: Here we can see that Music asset ID 1004 has been removed since its quantity was 2

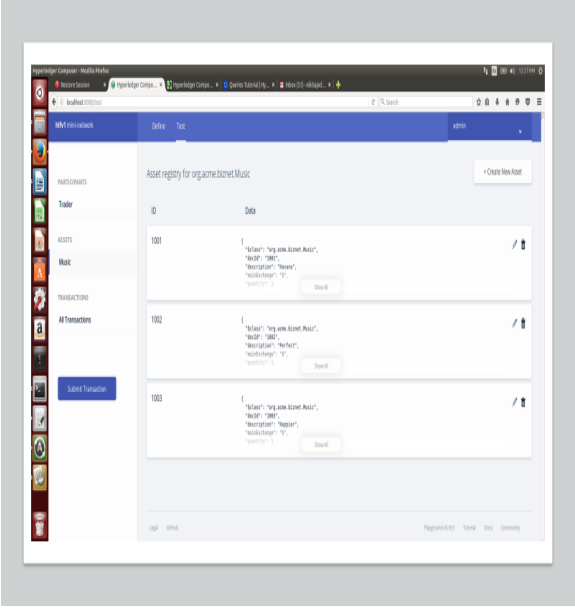
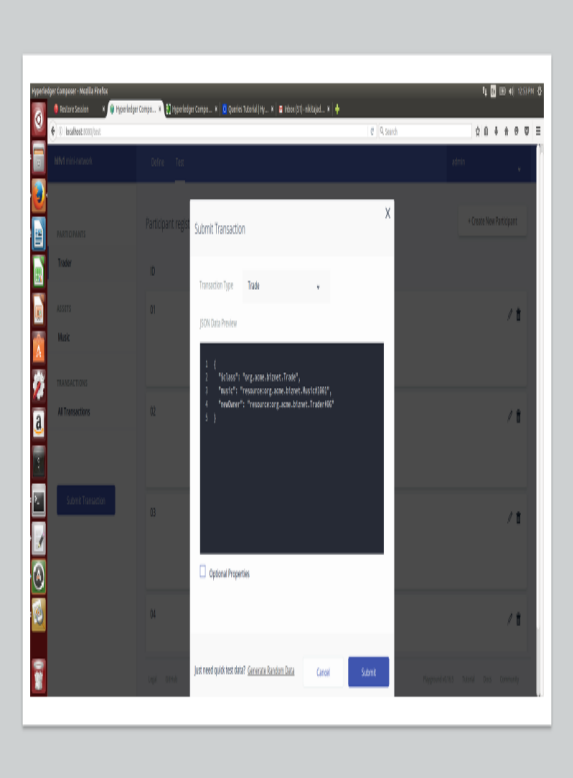


Fig 7.n: We will make a transaction between owner Camilo Cabello and Trader 06



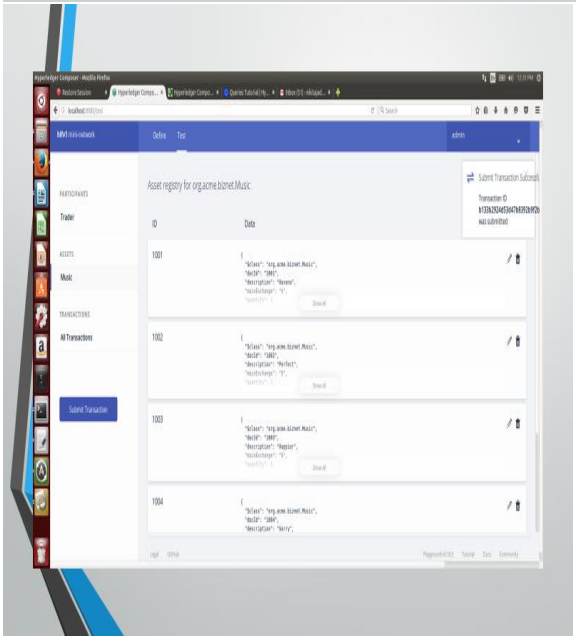


Fig 7.o: Now the ownership is changed to the Trader 06 but the IBM Hyperledger database still contains the original author Camilo Cabello due to which Trader 06 cannot redistribute the file to anyone and earn the money from it.

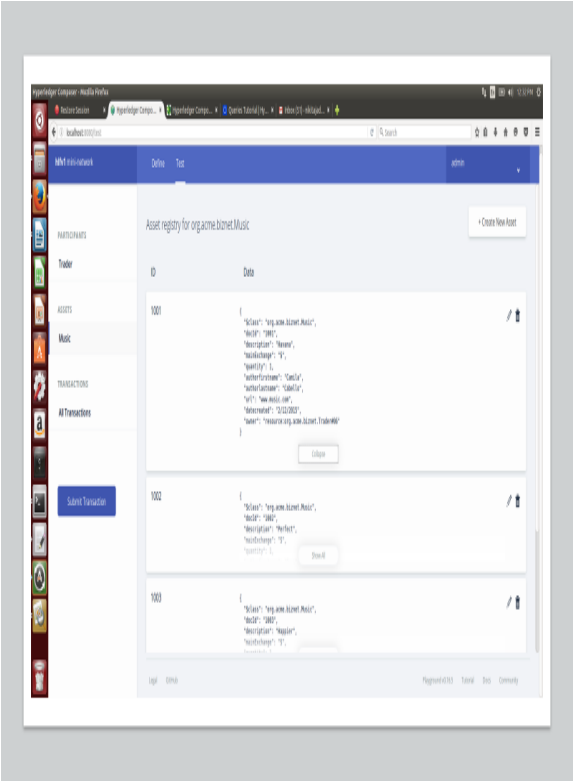
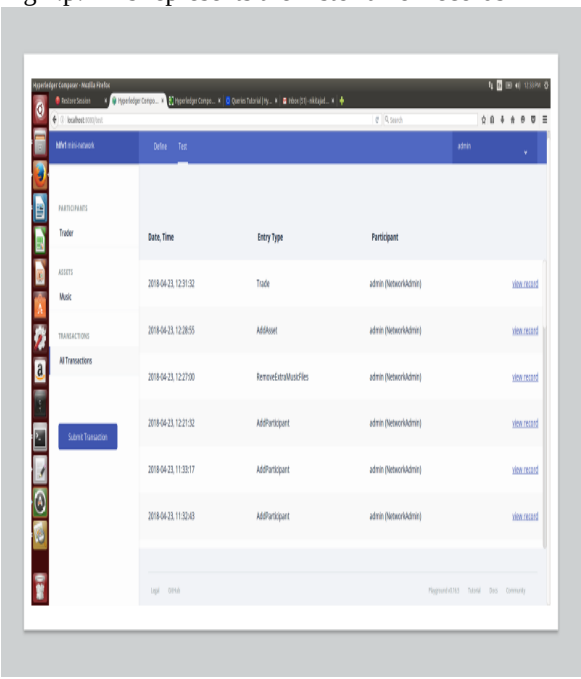


Fig 7.p: This represents the historian of records



XV. FUTURE WORK

We're only beginning to see the potential of blockchain technology. Innovations in blockchain have made it increasingly attractive – and usable – to organizations outside the cryptocurrency world. Financial institutions, political organizations, cloud storage providers, and even online casinos have all started using blockchain technology. We don't know where blockchain technology is going next, but we can't wait to see.

Future possible enhancements in the music industry:

1. Blockchain technology could radically transform a culture of 'black boxes' and non-disclosure agreements, bringing transparency throughout the value chain.
2. Revenue from a stream or download could be distributed automatically between rights holders as soon as a track is downloaded or streamed.
3. The low transaction costs of cryptocurrencies facilitate micropayments. They also allow content creators to receive tips, even in very small sum.
4. More broadly, research needs to be extended to potential applications of the technology in those music industries not directly related to recorded music – and, indeed, in other creative industries entirely. This will provide the agenda for our own future research.

XVI. LEARNING OUTCOMES

Developing the blockchain technology as an application is challenging and exciting. Some of the major lessons learnt were as follows:

1. Prior Comprehensive Understanding of Blockchain is necessary before developing an application
2. Selecting a Tool depends on what all features needs to be deployed on a business network application, in this application Hyperledger Tool is selected as permissioned network was necessary. Also, Hyperledger Tool is tolerant to Practical Byzantine Failure.
3. Installing Prerequisites with the prescribed requirements is important and intricate.
4. Apart from understanding the basics of Blockchain, the major role is designing and modelling the required application according to its varying necessities.
5. One would understand the power of Blockchain only when its designed and the benefits are seen in real time.
6. Making the purchase through the cryptocurrencies and developing it as an application would make the music industry more efficient and completely immune to the black boxes. The main aim is establishing good terms of use and Fair Trade.

Developing the application with Blockchain Technology helps to understand how it can emerge as a technology in future.

XVII. CONCLUSION

In conclusion, Block chain technology has many benefits as it stores data in distributed ledger in a transparent manner and communicates via peer to peer network. Developing a Music Industry application using Blockchain Technology where the copyrights information is stored in the Distributed ledger ensures that the true owner gets fair trade of their music.

XVIII. ACKNOWLEDGEMENTS

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