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Blockchain or the Chaingang?

Challenges, opportunities and hype: the music industry and blockchain technologies

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Preface and acknowledgements

The author gratefully acknowledges the award of a CREATe Industrial Fellowship, which has supported the research for this paper. The opportunity afforded by CREATe and the University of Glasgow to spend some time digging deeper into the topic of blockchain and music is one that I value greatly. This discussion paper is in large part thanks to the vision of the CREATe folk to encourage industry people to take a longer, deeper view of a topic than our daily business normally allows It has been an invaluable experience. As part of my research, I interviewed a wide range of individuals from technology visionaries, to heads of collective rights management organisations (collecting societies) to recording artists, to music managers and label chiefs. The blockchain is not a static technology, it is a set of protocols that continue to evolve rapidly. Invevitably, whatever detail I set out here will date rapidly, but I hope that the broad scope of what I've described will remain relevant for some time in theoretical, strategic and policy terms. It will be interesting to see if or when some of the visions set out here and the possibilities described within them, see the light of day. I hope that the best of them do, the world will be a richer place for them and I hope that music and musicians will be better off too.

I would like to thank all my interviewees. Whether I used your words or not, your ideas and thoughts on this topic were invaluable to me. In particular, I should like to thank Professor Philip Schlesinger of Glasgow University for his guiding hand and encouragement, Martin Kretschmer, Paul Brindley, Steve Mayall and the guys at MusicAlly, Ms Judith Silver and numerous others for their help and support. The wisdom here mostly belongs to those I interviewed, the errors are entirely mine.

Introduction

On October 31st 2015 *The Economist* magazine ran a front cover story headlined "The Trust Machine: how the technology behind bitcoin could change the world". It signalled a key moment when blockchain, effectively the operating system that powers bitcoin, became visible to the mainstream or at least to the influential readership of the Economist magazine around the world. Excitement and interest in this technology had been surfacing rapidly over the previous few years and now it was beginning to excite real media coverage and some considerable speculative investment interest. Three years previously, it was the digital currency bitcoin itself, which had been exciting similar levels of interest. As understanding grew, so attention widened to encompass blockchain and the various protocols of which it is made.

Blockchain is essentially a set of protocols previously known as a "distributed ledger" system. Another Economist article published in March 2016, describes it well:

> *Blockchain is… a database that is maintained not by a single actor, such as a bank, but collaboratively by a number of participants. Their respective computers regularly agree on how to update the database using a "consensus mechanism", after which the modifications they have settled on are rendered unchangeable with the help of complex cryptography. Once information has been immortalised in this way, it can be used as proof of ownership.*[1]

The reason why this has become such a hot topic is that technologists and business people see, in these basic characteristics, immense potential for using blockchain beyond the financial services sector where it was conceived, in many different areas of the economy from energy to health, from transport to music and even as a form of digital democracy in society as a whole. Melanie Swan, founder of the Institute for Blockchain Studies, writes:

> *Blockchain technology invites a new level of thinking about the possibilities for societal design and the sensibilities of the emerging Cryptocitizen.* [2]

The key characteristics that are attracting so much attention are the efficiencies to be derived from a network that is distributed and not centralised, combined with the permanence of the record or ledger at its heart that is cryptographically secured. This attracts those that see profound ideological implications in something that is an alternative to systems that are controlled from a single central point. Melanie Swan encourages us:

> *Think of it more as a giant interactive Google-doc spreadsheet that anyone can view on-demand and administrators… can continually verify and update to confirm each transaction is valid. A shared truth state in a distributed system.*[3]

Like the internet, there is a fundamental strength which arises from the elimination of vulnerability of a single point of failure. Blockchain attracts those that understand the need for greater cryptographic certainty in a world increasingly vulnerable to cyber-crime. The result is a technology promise that appeals to some of the most radical idealists in society as well as some of the most fervent capitalists.

By their very nature, descriptions of the characteristics of blockchain tend to descend rapidly into highly technical language. Developers and programmers have a tendency to get quickly into the weeds of byte-sized detail. For the sake of clarity, I will try to keep this discussion at a fairly high level and write as simply as I can throughout this paper, however it is hard not to be drawn in to some of the tech detail as we try to prise apart some of the arguments and different views. As we shall see, some of those differences of technology approach give rise to great ideological and commercial differences.

I will go into more detail further on, but it is worth pointing out straightaway that there are two different kinds of blockchain network with very different characteristics; they are referred to as *permissioned* or *permissionless*. Both may be used to create a permanent synchronised ledger, but have rather different characteristics. In the case of *permissioned* networks, all the parties who access the network know each other and are already trusted. Banks or major record companies might use this kind of network. They require less cryptographic validation systems and display fewer of the open benefits of transparency that some tend to think are inherent in blockchain.

It is in *permissionless* blockchains that we find the more radical characteristics, which excite the visionaries. *Permissionless* blockchains do not need to know who is operating on them. They operate trustlessly, on the one hand making transactions transparent, while on the other keeping identities and contents of the transactions anonymous, if so required. In this context the validation of transactions is achieved by a process called mining which through complex cryptographic games ensures that, in any one transaction, seller A only sells to buyer B and not also to buyers C and D. The validation can also make sure that buyer B is good for the money. One final element that is being developed to work in this kind of environment is a *smart contract*. This allows a set of rules to be executed on a network according to some pre-agreed rules; apparently simple but highly complex to achieve. If *smart contracts* could be made to work at scale they could have profound consequences for the way intellectual property licensing could be conducted in the future. So far demonstrations have been one offs, which omitted to answer all the questions of running *smart contract* on a blockchain. How smart contracts develop may turn out to be a key element in the transfer of the technology from the financial services sector where it grew up to other sectors where it is attracting lots of attention.

For the music industry, some of these characterstics might mean that creators could, in theory, radically reduce the cost of unit transactions, thus potentially enabling content licensing for very small sums to be viable. Equally, the transparent record keeping inherent in the system has the potential to lead incrementally to the creation of a Global Repertoire Database (GRD), a kind of holy grail of the digital music industry. Some other functions that potentially could be performed on blockchain networks could relate to the establishment, validation and tracking of identities, so that individuals could be uniquely identified (e.g., as the performer on a recording). Equally good behaviour in, for example, transactions or in rights distribution speediness could contribute to developing an online reputation, which in turn could effect the sorts of terms that are made available for a particular individual or business.

The vision of a blockchain powered world is one of total digital transformation and integration. It is also much easier to imagine it happening, like so much in the digital space, if we started from a blank page. Much more challenging is to figure out how we might migrate from our current status to such a wholly digitised, blockchain powered world.

In the coming sections, I shall take a look at how bitcoin and blockchain captured the public imagination, some of the technology issues at the heart of blockchain and a key dispute that is taking the bitcoin community in different directions and has a bearing on any possible music applications. I will explore the kinds of initially superficial ways in which blockchain represented an attractive technology to the music industry and then go on to try to capture some of the excitement and some of the voices that have been generating so much deeper interest in the subject in relation to music. Finally, I will try to draw the whole thing together and provide some discussion of how this might all unfold what the opportunities are and what some of the obstacles might be.

Media, mystery and intrigue: an extraordinary series of events

To understand the reasons why blockchain burst on to the front cover of *The Economist* in October 2015 with such a flurry of excitement, we have to return to events surrounding its overlord, bitcoin, one of the first alternative digital currencies. The idea of bitcoin was initially developed to allow for commerce on the *darknet*, the underground part of the internet mostly frequented by pornographers and organised crime. Interest had been growing during a series of surprising events and revelations in the previous few years. Most prominent perhaps was the shutting down by the FBI of the Silk Road darknet site (an underground website established in 2011 that used bitcoin to allow the purchase and sale of illicit items such as guns and drugs) and the shock arrest, in October 2013 in a San Francisco public library, of 29 year old Ross William Ulbricht, the so-called mastermind of the Silk Road. Ulbricht who had operated under the pseudonym of the Dread Pirate Roberts and had even given interviews to the press in this guise, was subsequently sentenced to two life sentences with no chance of parole. As interest in blockchain continued to percolate to the mainstream, further controversy arose as a major currency exchange, called *Mount Gox*, where bitcoin was being traded globally, went bust in April 2014 under suspicious circumstances including the sudden disappearance of 850,000 bitcoins. Meanwhile, the use of *Turing Boxes* in bitcoin architecture, a tool used for cryptographic validation purposes, was also leading to interest in the figure of Alan Turing. The film, *The Imitation Game* was released in 2014. It explored Turing's decryption work during WWII and his enormous subsequent influence on the overall development of computer science. In greatly delayed recognition of his huge contribution, the UK government subsequently established an Alan Turing Institute for research into data encryption, currently housed in the British

Library. The connection between commercial and political success and cryptographic genius was beginning to be established in the public imagination.

There was still much more intrigue surrounding bitcoin. The identity of the creator of bitcoin itself, the enigmatic Satoshi Nakomoto, has never been confirmed for certain. Indeed it may be that no such person ever existed. An initial white paper outlining the bitcoin code in 2008 was published under the name of Satoshi Nakomoto, but no one knew who this was. It was not until late 2015 that a world leading IT security expert called Dr Craig Wright was identified by *Wired* magazine and tech mag *Gizmodo* as the likely real-world identity of Satoshi. On the day that the magazines published their reports, media surrounded the home of Dr Wright in Sydney in the expectation that he might make some statement, even an admission of his identity. But hours later, instead of any public statement, Wright was arrested by Australian Federal Police, apparently on tax matters, related to the handling of a significant quantity of bitcoin. No further confirmation of whether or not he is indeed Satoshi has ever subsequently emerged, but in this curious way, blockchain and bitcoin have entered culture and the popular imagination. They have even produced their fair share of parody songs on *YouTube*. Number one on the top blockchain songs playlist[4] last year was a parody of Taylor Swift's *Everything has changed* which features the memorable line "all I know is that since the blockchain, everything has changed."

The effect of this bizarre sequence of events was to produce a huge amount of interest from developers and innovators who started working away in the background to explore all the possibilities that the blockchain could enable. The notoriety of bitcoin, was perhaps the factor that made it easier for developers and futurists to shift their focus to the underlying blockchain technologies and start to explore and discuss blockchain as the real enabler of immense potential change. Whereas bitcoin, by definition, was designed to live and breath in the financial services sector, blockchain could theoretically be applied to all sorts of other kinds of contexts and not just to transactions. It might, for example, have potential in other kinds of globally networked data fields such as music and the licensing of music; always an entertaining sector in which to try technology experiments.

After the 2008/9 worldwide credit crunch, some in the financial services industry were motivated to seek new transaction, payment and exchange systems that

could help lessen the problems of the past. If they could make the industry more efficient in the process even better. In this period, there was considerable disruption underway in the financial services sector and coincidentally in the music industry too. Following the 2008 launch of Spotify, the music industry began to respond to what rapidly looked like another cataclysmic change in its business model. Streaming subscription services were moving from edge case to mainstream digital revenue sources. Led by the innovations of Spotify, Pandora and other more niche services, music subscription services were steadily attracting consumers. The nature of digital meant that selling ownership of music was rapidly giving way to selling access to it. This was also reflected in an increasing decline in digital download sales which seemed to accelerate markedly around 2014, spurring Apple to acquire the Beats streaming service and subsequently launch its own Apple Music subscription service in June 2015.

Compared to the revenues from digital downloads and from physical product sales previously, however, for certain sections of the music industry, the value of revenues passed back from digital service providers via intermediaries to artists and other creators, like songwriters, was conspicuously low. This realisation prompted a wave of protests from creators and their representatives and inevitably spurred a growth in interest in alternative methods of monetisation.

Lots of major artists, like Taylor Swift, experimented with holding their music back from release on the major streaming services in order to maximise the higher margins offered by windowing on older media such as CDs and downloads. Enthusiasts of blockchain looked for more systemic alternatives. Blockchain raised expectations that a whole new decentralised layer of the music economy could be created using this type of technology.

As I started to read more about the blockchain in early 2015, I discovered that it was still rapidly evolving in character. In fact, the more I read about it, the less I understood, despite the gushing enthusiasm of some of its leading pioneers. It became clear that my lack of understanding might have less to do with limited intellect and more to do with the fact that the protocols, solutions and underlying technologies were still being actively developed and evolved. Many of the concepts being talked about like *smart contracts*, for example, were still to be fully worked through and applied in a myriad contexts to prove on the ground and at scale what the theory suggested.

Often, when reading about scientific or technological developments in the press or online, there is an awareness that the article was published some time after the event. We tend to feel that by the time we get to read something, that the activity in the real world has probably moved on and is maybe six months or more ahead of what is being discussed in the article. In the case of the blockchain, however, with the frenzied heat of excitement that seemed to be increasing around the topic, I found that many of the articles I was reading online on the subject, were turning out to be at least six months or more ahead of the point which the technology had actually reached on the ground. This is the definition of hype. Part of my effort here has been to separate the hype from the reality, without wishing to be a dampener on the enthusiasm..

Blockchain: a commercial layer for the internet?

Blockchain technologies display such immensely broad-ranging potential that they have the appearance of taking our entire view and experience of technology to a new level, rather as the emergence of the internet did in the nineties when, for better or worse, the world-wide web seemed about to set all information and content free. The extraordinary nature of blockchain technologies is the degree to which they start to look like an entirely new layer that could sit on top of the internet.

Futurist pundits Dan and Alex Tapscott put it well recently in a blog for *Coindesk.com*:

- *The Internet is entering a second era, one that gives us another shot to achieve a prosperous future… .At the core is the biggest innovation in computer science in a generation. It is the technology underlying the digital currency bitcoin – the blockchain.*
- *This technology platform is open and programmable. As such, it holds the potential for unleashing countless new applications and as-yet-unrealized capabilities that have the potential to transform everything in the next 25 years.* [5]

Blockchain looks as if it could enable a robust commercial and transactional capability across a very wide range of applications and subject areas not just financial services. William Mougayar, a general partner at Virtual Capital Ventures and previously at HP and Cognizant, wrote recently on a Forbes website blog:

> *…the Internet (and websites) brought us since 1994: personal communication, self-publishing, e-commerce and the social Web. Each of these four phases was defined by the functions they disrupted: the post-office, print media, supply chains/physical stores, and the real world. Now we are entering the blockchain promise phase, demarcated by the key theme of decentralization of trust, or unleashing the flow of value without intermediaries.*[6]

Other comentators such as Melanie Swan, Founder of the Blockchain Institute, project the scale of influence even wider:

> *In addition to economic and political benefits, the coordination, record-keeping and irrevocability of transactions using blockchain technology are features that could be as fundamental for forward progress in society as the Magna Carta or the Rosetta Stone.*[7]

As the momentum of growing interest in blockchain accelerated, it inevitably increases the range and breadth of areas in which the technology promises to be applied. Brian Forde and Michael Casey of MIT Media Lab maintain, in a recent magazine cover-article:

> *The conversation around bitcoin has shifted from curiosity, confusion and doubt to one in which serious decision-makers are recognising the many ways blockchain ledgers can be used.*[8]

MIT Media Lab is currently host to over 50 doctoral students working on financial services applications of blockchain. It is becoming clear that blockchain technology has gone mainstream very quickly, possibly too quickly. There is now a public debate about its value and application. It is arousing enormous interest across a wide range of areas including the mechanisms of government itself.

In January 2016, the UK Government's Office of Science published a report with a foreword jointly published above the names of two Government ministers: The Rt Hon Matthew Hancock MP, Minister for the Cabinet Office and Paymaster General and The Rt Hon Ed Vaizey MP, Minister of State for Culture and The Digital Economy. The report is entitled *Distributed Ledger Technology: beyond block chain: A report by the UK Government Chief Scientific Adviser*[9] . The

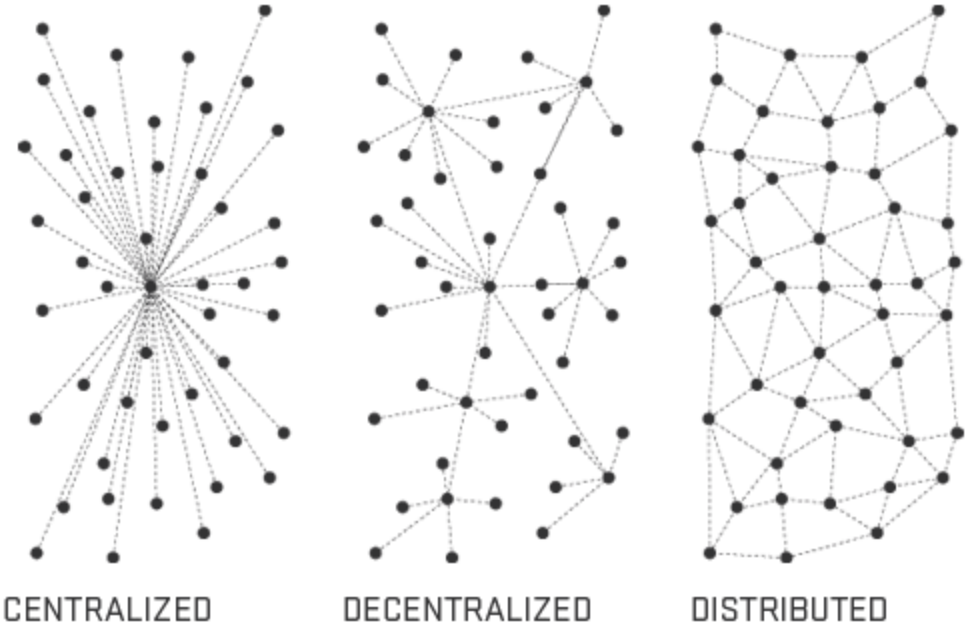
report is keen to see the UK Government and its various agencies lead the charge in developing applications of blockchain to support the more efficient implementation and communication of public policy and to help drive private sector innovation. The willingness of governments to point to a particular technology as a key solution to its own challenges is unusual and forward looking. While the application of many of the ideas set out in the report are at a nascent stage, the desire to see development focus in this area is significant, particular as it anticipates application well beyond the financial services sector.

Despite the persistence of hype and over-excitement around blockchain, it is hard not to feel that we are indeed witnessing the emergence of a key new set of technologies, which has application across so many areas of industry, society and politics as to have historic significance, even if the speed with which it is likely to be adopted may be less rapid than its advocates would prefer. In the first internet bubble (1995-2000), despite the phrase being woefully overused, the advent of the internet did truly represent a paradigm shift and perhaps, blockchain will prove to be another., whether or not we relish a future for ourselves as unfettered capitalists or in the vanguard of the cryptocitizenry.

With such a diverse range of agendas at play, it is hardly surprising that the field of blockchain development is also rapidly diversifying. New entrants are busy trying to differentiate themselves from each other while still holding on to core blockchain protocols. The ugly term *coopetition* well describes the nature of the market here. The collaborative nature of open source development comes reguarly into surprisingly sharp contrast with the naked ambition of the purely financially motivated.

We will take a closer look at how that coopetition is manifesting itself both among different technology players and then among music related projects, but first it will be helpful to attempt to clarify some of the basic technological characteristics of blockchain.

The key differentiator between traditional legacy systems and the blockchain is that the new systems are not subject to central control and command. They may be in one of two non-centralised states: decentralized (hub and spoke) or fully distributed. The graphic below [10] illustrates the different kinds of computer network environment:

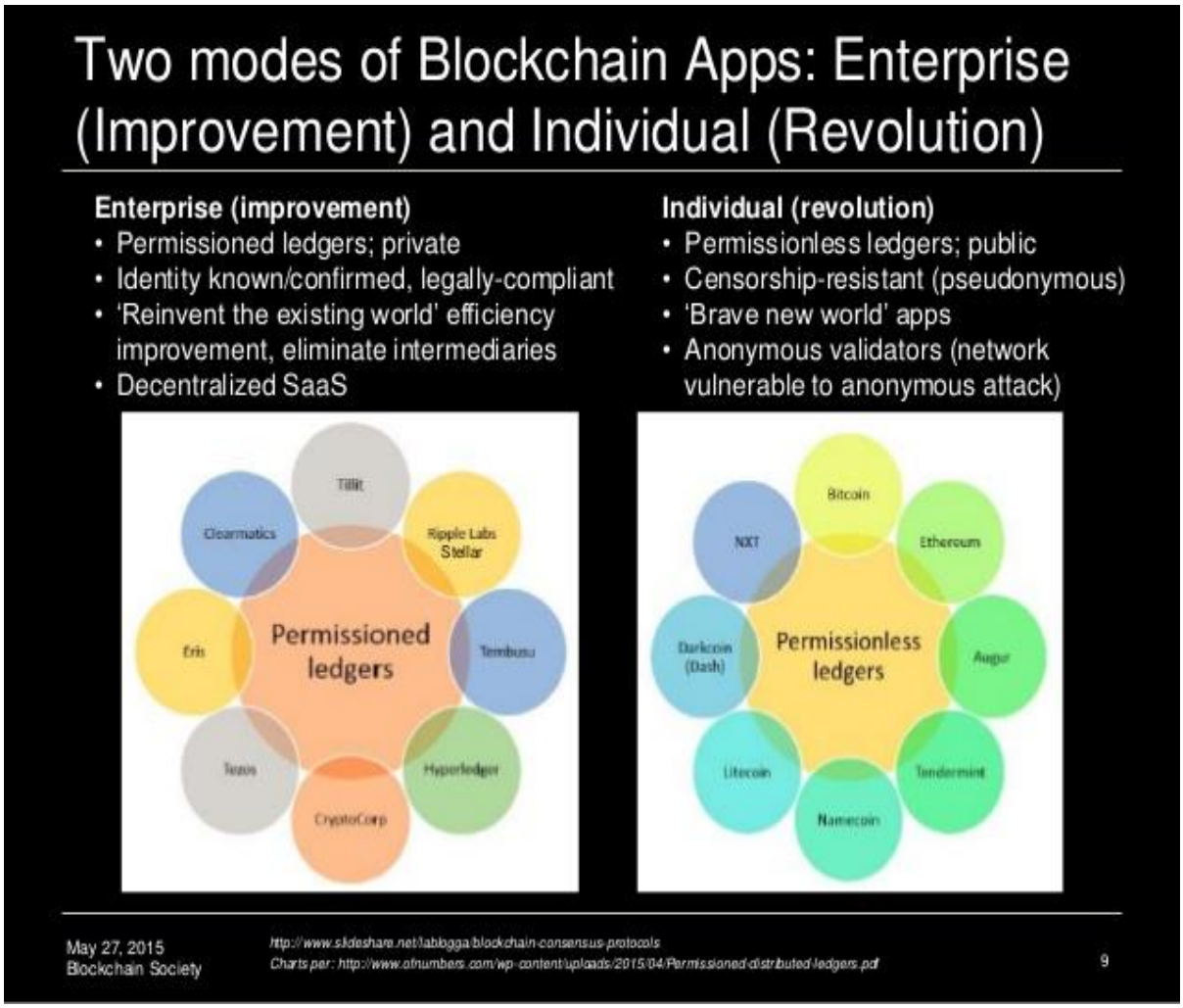


The obvious benefit of the decentralised or distributed systems is that like the internet, transactions can be routed by the quickest possible path and not forced through the centre, which no longer serves as a bottleneck – although it is only the fully distributed systems which completely avoid that problem – a hub can still be a bottleneck to its spokes. Technologically the distributed solution can be much more efficient and therefore help lower transaction costs. A decentralized system is a good incremental step along the way. Both solutions remove a single point of failure or attack. Politically, it also allows a more collaborative environment in which all players can provide similar or equal levels of service.

Then things start to get a bit more complicated. It is important to understand, as I mentioned earlier, that there are two broad modes in which blockchain-related applications might run: *permissioned* and *permissionless*. In *permissioned* networks, the identity of all participants in the network are known to each other, they have trusted confirmed identities and are legally compliant. *Permissioned* networks are private, not open or public. The parties might be international clearing banks. Indeed, it is this kind of *permissioned* blockchain in which the big international clearing banks are currently investing. This kind of enterprise blockchain could well act as an evolutionary improvement on current centralized systems. The benefit of using blockchain in this context is more about reinventing the existing world, by making it more efficient and eliminating numerous layers of time-hungry and costly intermediaries from a transactional process, and being able to keep a distributed database in sync and secure. This

looks like the kind of use to which a corporate player might well put the blockchain. If the music industry is likely to see collecting societies or major labels adopting the blockchain for their own systems, then *permissioned* networks are mostly likely to be their choice.

Then there are *permissionless* blockchain applications; these are the ones which have the capacity to be much more revolutionary. Individual ledgers are *permissionless* when they are open to anyone. They are public and transparent. They are also censorship-resistant which means that they can be anonymised: for example, no one needs to know who is transacting, only what is being transacted. The transactions on these networks can be validated anonymously too by miners who can solve complex cryptographic problems that contain validations of the sums transacted, without the miners knowing what they are validating. The effect is to create a good deal of security in the environment.



The idea of mining on the bitcoin platform is that it is both the means to validate transactions and the means by which miners can earn some bitcoin of their own. The problem that bitcoin tries to solve with mining is that of validation of a transaction. Does seller A own that which he/she is selling? Does buyer B have the money to make the purchase? Is seller A only selling to buyer B or is he/she also trying to sell the same product to buyers C and D? These kinds of questions can be posed and answers produced by bundling the questions together and through the power of randomizing and encryption creating a puzzle, to which a computer can find an answer. If the same puzzle is posed to at least six or seven different puzzle solving computers and they all come up with the same answer, then it can be deemed that the answer is correct. If players on the network who are not directly involved in this transaction can be incentivised to earn bitcoin as a result of solving the puzzle, which will validate the transaction then they may go ahead and try to solve it.

The trick is that the system ensures that the computing power required to solve the problem is less than the computing power required to hack the transaction. As the network develops and the number of bitcoins released into the network increases, the complexity of the problem increases and the amount of computing power required to solve it increases too. This means that the amount of computing power required to hack the transactions is going to be too great to be worthwhile for any potential hacker.
As development company, Colu, puts in their explanations:

> *Despite its openness, the blockchain is highly tamper resistant. Attempting to manipulate the state of the ledger requires harnessing enough computational resources to overwhelm the rest of the network. Changing a historical block becomes exponentially harder the deeper it is in the chain. The economic incentive set forward by the block reward creates a feedback loop that tends to increase security by encouraging users to spend more computational power in the competition to find new blocks.*[11]

The problem is though that, as the complexity increases, the number of people who have the required level of computing power available to them to solve the puzzles thrown up by the system, decreases. The result is that miners start to aggregate their computing power and form mining pools. Gradually, over the

last few years the number of mining pools on the bitcoin network has consolidated as the complexity of required problem solving has increased. Today, allegedly, there are only three main mining pools and two of those are behind the Great Firewall of China. This is not the kind of invulnerable, democratised scenario that the inventors of the bitcoin / blockchain architecture envisaged and leaves the system open to questions of whether it is now vulnerable to a different kind of influence.

Furthermore it is worth bearing in mind that the kind of problem that these miners are solving is rooted in the financial services world where that which is transacted is largely currency and the questions of validation are about identity, creditworthiness and ownership of sufficient funds. In the cultural world of music, the question of which artists contributed what to which track and who owns precisely which sub-tranche of intellectual property rights or derivative rights such as distribution rights to a particular track by format and by geography may vary considerably. So, that ingenious problem solving method which works in the financial services sector may not so easily transfer to the highly fragmented rights environment of music.

Alongside the concept of the blockchain, another linked area that has become attractive to reformers in many fields is the concept of a *smart contract*. The notion of a smart contract is a piece of code that runs and executes actions based on a set of pre-agreed rules, which derive from what is signed into a contract. So if an artist were to determine that their music could be licensed for use in an online advertisement for any product except for weapons, drugs, alcohol or tobacco, at such and such a price, and for such a period in this many territories, a smart contract could be created that could be run on the blockchain or on a distributed ledger to enable the answering of any request which fit those criteria.

This is where we also start to meet some of the challenges in the current state of these systems. The challenge is that the blockchain itself cannot, in its original bitcoin form, hold a large datafile like a contract. In order to remain in sync and be easily validated globally, it has to link to large data sources elsewhere. The question then arises as to how to ensure that those data sources remain robust, authoritative and decentralized. This turns out to be quite a complex and difficult technological problem. If the smart contract were even nearly as sophisticated as any existing music industry contract and even if

somehow, it could be simplified down to its main commercial terms (and avoid all those vague, catchall clauses that are so useful in negotiations), the volume of data associated with a licence of this kind would be much larger than the basic 60kb maximum block size on the bitcoin blockchain. This would be particularly the case if you wanted the blockchain to manage comprehensive licensing across all the combined rights areas of even a single piece of recorded music. Even more data would be necessary if the blockchain were also expected to pay out correctly to all the contributors in all the relevant territories in close to real time. A system that can complete tens of thousands of transactions a second is not the same as one that can trigger smart contracts which may have to exist on some parallel distributed system.

Of course, there are many brilliant brains out there attempting to resolve these sorts of questions. Bitcoin has already spawned many imitators, interpreters and improvers. Blockchain is now doing the same thing. There are many companies deriving versions of the blockchain either linked to bitcoin or not. Here is how one of them, Colu, describes the value and usefulness of their particular version of the blockchain:

> *The Colu platform uses the bitcoin blockchain but is designed to be blockchain agnostic and even connect to multiple blockchains.* [12]

Having their cake and eating it too, maybe, but the free market is hard at work here. While, at the time of writing, bitcoin is still the most advanced network in commercial operation to be based on the blockchain protocols, whether that remains the case going forward is less obvious. Other entities, which have learned from some of the constraints of bitcoin, are already seeking more flexibility in next generation platforms and in seeking new solutions to some of these controversial issues. The Ethereum platform, for example, is the creation of another open source community. Ethereum seeks to overcome some of the limitations of bitcoin by aspiring to an infinite block size capability and validation cycle times of seconds not minutes. It is also the first platform to support smart contracts which may turn out to perform highly valuable functions in many sectors, including music.

In fact, there are many different companies experimenting with blockchain technology in its various forms. Tim Swanson noted that, in his report on *Permissioned-Distributed Ledgers in early 2015* , there were already over 550

forks of the bitcoin codebase[13]. He explains the competitive reasons why this was happening:

> *Once a subset of coin holders and miners becomes solidified as the "in" group, it motivates those in the "out" group to fork the code, spin up a new chain and distribute new coins to their own special interest group (usually some small clique)[14].*

This gestures towards what has become, as we shall see, the somewhat troubled bitcoin environment.

In early 2016, challenges appeared among the leaders of the "leaderless" bitcoin community and seemed to threaten the ongoing viability of the community itself. The challenges related very specifically and quite technically to issues in the underlying blockchain protocol. Purists believed that the bitcoin version of the protocol should remain untouched, requiring the blocks in the chain to be no larger than 60kb of data and that transactions should occur in a cycle of every ten minutes. The reformers wanted to allow for larger blocks of transaction data to be handlable and for the cycle of transactions to be sped up. They wanted to do this so that bitcoin could start to compete at the same kind of scale that current credit card companies operate. Bitcoin still only manages a small fraction of the numbers of transactions daily that incumbent credit companies manage.

In an article in the *New York Times* documenting the problem, an ex-Google employee and blockchain advocate, Mike Hearn, dramatically declared the end of bitcoin because of these problems:

> *When Mr. Hearn began pushing for changes to the core bitcoin software to allow for larger blocks of transaction data, he faced immediate resistance. Gregory Maxwell, a largely self-taught programmer who had worked on Wikipedia and the Mozilla web browser, both open-source projects, said that larger blocks of transaction data would be harder for ordinary computers to process. The result, Mr. Maxwell warned, would be to hand control over the network to big companies that could afford powerful computers.*
>
> *For Mr. Maxwell, slower transactions seemed to be a secondary issue to protecting bitcoin from centralized sources of authority[15].*

Following the publication of this article, Mike Hearn very publicly abandoned the bitcoin project, vowing that it had become a failure. Unsurprisingly the departure of one, albeit brilliant leader, did not result in the collapse of the network. As perhaps the very spirit of the blockchain demanded, immediately following his departure, the remaining advocates rapidly solved their differences and reached a compromise agreement about the way forward despite or perhaps because of Mr Hearn's dramatic statements.

The debate highlighted here is largely one between those who have a vision for a radical political destiny for bitcoin and those with more corporate interests that are essentially commercially driven. To be fair Mike Hearn would probably argue that if the commercial viability of the system could not compete with incumbent solutions such as Visa or PayPal, then any ideological benefits would be negligible too. The idealists see large corporate interests taking control of the development of the blockchain protocols as a negative development that militates against their grand levelling ideals of democratisation. This kind of debate is of course legion in technology circles; compare for example the debate over open source, open innovation and more proprietary technology development. It is almost a caricature of how technology seems to evolve in cycles from the theoretical to the practical.

Ethereum is an open source crypto-currency platform, alternative to bitcoin, It is one of those to have claims on developing clever new solutions to the problems inherent in running smart contracts, referred to above. Coders at Ethereum make use of a new solution to solve this problem of encrypting and managing large data files. It uses a solution rejoicing in the name of the Interplanetary Filing System (IFPS). IFPS is a distributed filing protocol which could allow documents or applications containing almost infinitely large amounts of data to be stored, encrypted and distributed across networks in a manner which is both secure, synchronisable and arguably relatively rapidly accessible. Exactly how all this fits together is still, as I write, somewhat hypothetical. The name IFPS may be someone's little private joke, but the model that it promises opens the imagination to many kinds of music transaction or licensing. IFPS is used extensively by new commercial enterprises running on top of the new open source platforms, such as ConsenSys and the Alexandria decentralized library project, among others. Song writer, musician and technology advocate, Imogen Heap, has talked animatedly about the appeal of a smart contract, which could theoretically manage an entire transaction of a music licence and the complete,

rapid distribution of revenues to all relevant interested parties and I will come back to a discussion of these ideas a bit further on.

The key thing about smart contracts though, is that this kind of problem had not yet been fully solved. The problem is that if the database of transaction, data and smart contracts is to be globally distributed and synced in as close to real time as possible, the amount of bandwidth necessary to ensure that synchronization occurs within commercially workable timeframes has to increase in proportion to the amount of data being referenced, changed and acted upon in the database. It is one thing to synchronise 60kb globally across a synchronized database that can sit on "everyone's desktop" – which is how bitcoin works. It is another challenge to do that with a set of hash links to contracts and data-sets thousands of lines long. For those that really want to get into it, this is where Turing Boxes acting as random oracles could potentially start to play a useful role. This also marks the point at which most peoples' technological, cryptographic understanding starts to taper off.

The 2009 banking crisis and subsequent exposures made it clear that there were lots of issues with legacy banking systems which some saw as over-reliant on centralized databases. Professor Mainelli, Emeritus Professor of Commerce at Gresham College in London and an alumnus of Trinity College Dublin, Harvard and the LSE, was particularly cynical of their nature as he revealed in an interview recently:

> *Historically our technology was a central database for a central third party model where I set up a trusted third party. Trusted third parties tend to cheat in one of two broad ways. The first cheat is bribing someone to register a false asset or transaction.*
>
> *The second way to 'cheat' is that successful central third parties often form natural monopolies. Once they have a central position with the data or with the rights, then they take advantage of it. This is true of banks, exchanges, the SWIFT network...*[16]

The motivation to find a better way to deal in the banking and financial services world has transferred itself quickly into other economic areas, such as music where similar concerns exist in certain quarters about monopolistic control practices.

In the financial markets, as Professor Mainelli points out, it is not simply a question of thought leaders opportunistically taking advantage of blockchain technology enabling a better way. It is more that current centralized systems appear to have so patently been found wanting as to demand new approaches. It may well be, however, that the main reason we are seeing major clearing banks investing in permissioned blockchain networks is because they are losing so much money to cyber theft, the big untold story that they would mostly prefer not to have discussed. I suspect that blockchain efficiencies may well be a euphemism in these banking circles for something akin to anything that might make them less vulnerable to rampant cyber fraud and similar forms of online crime.

Brett Scott on the p2pfoundation blog highlights this strange confluence of high capitalist imperatives and cyber-punk ethics. He invokes the somewhat gothic language of some of the more idealistic evangelists:

> *It all forms an odd, tense amalgam between visions of exuberant risk-taking freedom and visions of risk-averse anti-social paranoia. This ambiguity is not unique to cryptocurrency, but in the case of bitcoin, it is perhaps best exemplified by the narrative offered by Cody Wilson in Dark Wallet's crowdfunding video. "bitcoin is what they fear it is, a way to leave… to make a choice. There's a system approaching perfection, just in time for our disappearance, so, let there be dark".* [17]

This at times somewhat curious ambiguity of agenda is certainly producing huge new interest and investment in the financial services sector. As this interest migrates across to other sectors like music, the opportunities and visions arising from the technological possibilities have also attracted a range of differently motivated responses.

The ambiguous sex appeal of subversive technologies

The digital transformation of the recorded music industry is far from complete. Although in a few territories like Sweden, streaming digital media now represents nearly 80% of recorded music revenues, in other major economies such as Germany, CD sales are still around 50% of revenues. Although digital revenues appear exciting and progressive, despite the massively reduced manufacturing and distribution costs of digital, running record labels in this kind

of mixed economy still appears to be very challenging. Increasingly fragmented channels to market, lower retail prices, high development and marketing costs for artists, increased competition from other entertainment sectors such as gaming and persistent Wall Street pressure to maintain record company margins mean that the global industry has still not got near to a return to the heights of late nineties' CD revenues. The result of this is that value is squeezed at both ends: music-streaming services are seen to deliver poor royalties to artists and at the same time, other contributory parts of the industry have struggled to reform themselves in the face of digital challenges. So despite the traditional differences of position and agenda, there is an emerging sense that the overall industry model does need reform and there is a broadening willingness to consider new opportunities in emerging technologies, such as blockchain, which could turn out to be missing pieces in this difficult to solve puzzle.

The music industry is widely acknowledged to be one of the first industrial sectors to have been heavily disrupted by the internet and digital technology. Under the impact of the toxic combination of mp3 and the world wide web, the music industry suffered direct blows to its principle revenue model. Music's global nature and the small file size taken up by its content meant that it could be easily distributed digitally, even in the antiquated days of dial up modems. It was an impact from which the recorded music industry is still recovering, but the effect of the blockchain is much less likely to attack the music industry with the same speed or pervasiveness. The technology may offer benefits over existing systems, but it does not subvert them and render them ineffectual in the immediate and absolute way that Napster did. The creation of blockchain systems simply does not result in the ability of consumers to hijack content wholesale.

Blockchain requires a much steeper adoption curve; one that may gradually come into being because of its increasingly obvious benefits as much as from visible failures in existing models. A process of awareness building is underway, progressing through personal and corporate evangelism, sheer individual curiosity combined with the industry's typical but in this case quite useful, perennial appetite for associating with anything trendy which might help raise a few artists' profiles above the noise.

As a digitally native set of solutions that draws on the robustness of peer to peer networks, blockchain takes the logic and effectiveness of distributed systems

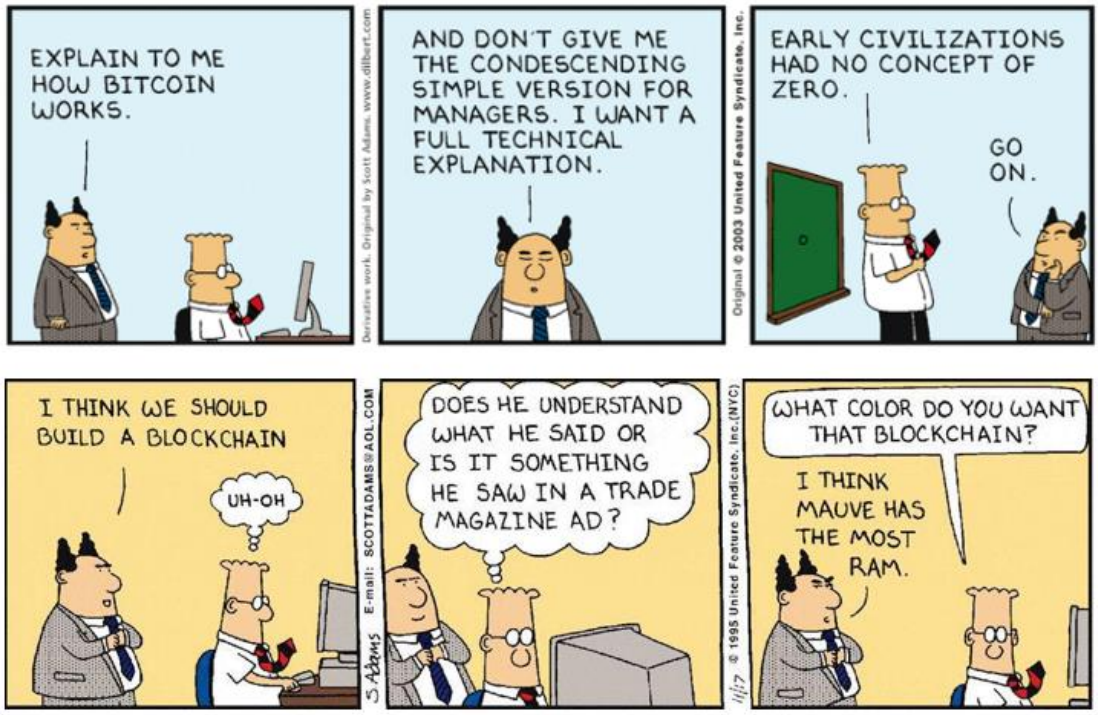
much further than bit torrent or earlier forms of file sharing. It matches the highly reproduceable nature of digital assets with a method of data encryption and transaction tracking that is low cost and authenticated. It has an inherent robustness that makes disputes around transactions less likely to arise and may even make an increasing volume of low level transactions feasible and cost-effective. These are the reasons why it is exciting and, refreshingly, these benefits are about increasing economic value not decreasing it.

For music, the blockchain is also significant, at least theoretically because, as we have seen, it has relevant application across so many dimensions of the music business as a whole and that is perhaps why some individuals have become so evangelical about it. Many inside and outside of the music industry believe that the architecture of the industry is fundamentally in need of reform. They are hungry for solutions to long-complained of problems such as lack of transparency or questionable royalty trails due to faulty or non-existent data. For all these reasons, blockchain has potential relevance to artists, labels, publishers and major music institutions like collecting societies.

The power of the internet when it first made its impact on the music industry was entirely about being underground, alternative and slightly subversive. Internet early adopters were not called cyber-punks for nothing. In the mid-nineties, the internet was attractive and valuable, not for the vast numbers of people accessing content on it because the numbers were tiny. The reason to build a website for a band was not because the artist wanted to control their own publication channel, nor because the artist wanted to open a channel of communication with their fans, nor even because they wanted to open a community for their fans to talk to each other. It was simply because, in 1994, if you wanted to look leading-edge and different as a band then you built a funky website and played with some new technology on it – and all the other old media would write about you and give you the "oxygen" of publicity that drove sales of your CDs.

To some extent, mobile apps and web technologies still work like that for bands. The new blockchain technology absolutely has that appeal too and there are certainly a lot more people talking about it today and gaining great PR value, than there are practical revenue-generating applications of it. The kind of underground cachet of cultural subversiveness and urban edginess provided

cerrtain kinds of musician and their future-leaning digital marketing teams with exactly the kind of anti-establishment profile for which they were looking.



Derivative work from Jack Gavigan (top) and Ken Tindell (bottom). Original from Scott Adams at Dilbert.com

For the music industry establishment, especially the major labels, peer to peer (p2p) technology as a solution has remained highly stigmatised and challenging since the catastrophic impacts of the earliest digital networks in the form of Napster and Gnutella, Grokster, Limewire and the like through early 2000s and then in the form of more recent types of BitTorrent networks such as the Pirate Bay or Kick Ass Torrents.

Post 1999, the recorded music industry was probably, out of all the different industry types across the whole economy, the sector that had been transported furthest down the road of trustlessness. For the captains of the industry, things had reached the point where music being anything other than free was simply, annoyingly and frustratingly, not where the kids were at - and the reason for that was largely bit-torrent and p2p technologies – or piracy as they put it. So it was obvious that they would be less than enthusiastic to adopt these or associated kinds of solutions.

The destructive stigma attached to these early anarchic applications of the technology meant that even the most obvious technological benefits have never

been allowed to be applied. In its earliest incarnation, the streaming service Spotify made use of p2p systems to reduce its bandwidth overheads. But not long after this fact became public knowledge, it appears to have been dropped by the company. It may have been that their infrastructural economics outgrew it or maybe the company simply wanted no truck with anything that might undermine its position or respectability as it engaged in the onerous task of licensing content from the major record company establishment and from the representatives of the indie sector who were no less conservative.

When the social media data we were gathering and analysing at Semetric, a big data analytics company focussed on the entertainment industry, was beginning to attract the interest of the major labels, they made it very clear that they loved what we were doing overall, but they did not want to use the bit-torrent data we were collecting. Semetric gathered social media interactions between music fans and artists and bands. Starting small, the company ended up tracking over a million bands a day, aggregating and analysing data about every Tweet, Facebook like or mention, YouTube play, Wikipedia page view, etc. The company started off with music and ended up covering film, tv, books and games as well before being acquired in the autumn of 2014[18]. As we trawled all these different data types, we found that the bit-torrent data displayed a very close correlation to sales data, which people always wanted to know about. The labels remained very sensitive to the possibility that any public acknowledgement of inherent value in bit-torrent data, of any kind at all, might be leapt upon by their policy opponents and used against them in lobbying governments for stronger copyright legislation. They would rather not see this data used than risk appearing to make any kind of inadvertent endorsement of even a byproduct of piracy.

So just as in the first flush of the internet, the underground alternative nature of the web and mp3 were what made it sexy to future-leaning music industry executives, the appeal of bitcoin was in the potent cocktail of its underground roots in drug-smuggling and gun-running mixed with the high capitalism of crypto-digital currencies developed in the decadent development labs at the bleeding edges of the financial services sector. As we have seen, Blockchain has clearly moved out from the shadow of bitcoin and its tainted Silk Road past. Today it has government approval although it still harbours more than a whiff of its radical past. In relation to music there is another irony here . The same technology visionaries who in the mid-noughties argued vociferously against the

imposition of anti-copying methods, Digital Rights Management (DRM) and Technical Protection Measures (TPM), invoking the complete inevitability of copying online, are now proposing the use of the next generation of that same p2p technology to put digital rights management (DRM) back in place around digital music transactions.

It was only a few years ago that to be able to discuss consumer transactions in music at all, let alone discussing the merits of a sexy new way to make consumers spend on music, seemed to reach a whole new level of unlikely. So there has been some progress after all.

Given this history, then, it is no surprise that the music industry responds with a kind of schizophrenia to technological innovation and its response to blockchain is no exception. On the one hand, label marketers, artists and their managers have become adept at exploiting the cultural hipness of underground new alternatives in order to maximise publicity and exposure to current projects. On the other hand strategists in the established trade associations, major labels and collecting societies are careful not to allow their corporate policy positions to be undermined by the over hasty adoption of new technologies with dodgy pasts.

Technology moves in cycles. There are times when nothing much seems to be happening and the levels of innovation appear to flatten out. We have enjoyed over twenty years of the world wide web. We have reached very high levels of penetration of high speed persistent bandwidth. We have had more than ten years of mobile smart devices. The levels of innovation that we experience when new platforms or devices first appear inevitably seem much higher in the early years than they do later. The shock of the new is exciting and memorable. It rapidly moves from the bleeding edge to the mainstream as commercial models are validated and driven to scale. This creates a cycle that turns the excitement of the new to something more mundane and commonplace over time. At the moment we are still in the early romantic period of blockchain, where publicity and attention are easy to gain. That cycle is already moving on in the financial service markets to a more duller, but reality-infused period of trial implementations and perhaps more measured assessments of viability and utility. For the music industry, the blockchain hype continues to work for now. If it is going to gain the beginnings of any kind of foothold then the hype needs to be turned sooner rather than later into a period of implementation.

Music visionaries and the problems blockchain might solve

If we stop to consider the ways in which music content distribution and discovery have developed commercially over the last twenty years, one might be forgiven for thinking that the only real innovation has been in streaming subscription services. The growth of Spotify, Pandora, SoundCloud, Apple Music, Deezer and all their competitors has created a new model. Approximately 75m early-adopter consumers have taken to it and mass-market consumers in different countries around the world are just beginning to becoming exposed to it.

The problem that this new model caused was nothing to do with its innovation in technology or even much to do with its business model, but mostly due to the way that the existing industry operated and the way it chose to accommodate a new model into an existing framework. Despite their fan-friendly exteriors and sophisticated mixtures of lean-back and lean-in listening experiences, royalties from subscription or ad-funded streaming services were still distributed through the legacy command and control systems of the record labels and the existing collecting society infrastructure. So while the labels and collecting societies had their issues from time to time with different services, they still felt overall that they were in control. Streaming was generating good new revenues and for the most part, the labels appear to have treated the service provider deals as retail transactions which, when interpreted according to most standard recording contracts did not mean having to pay out to the majority of artists more than single digit percentage royalties on net revenues.

The new streaming models seemed attractive to consumers and the established industry negotiated ways, more or less satisfactorily, to make them work financially. The problems were mainly for artists, songwriters and publishers, who had become increasingly vocal at their lack of share from the new service revenues. There was a growing feeling, particularly in the artistic community that more transparent solutions would be preferable and that there was something disproportionate about the way that digital service revenues were being passed on. The promise of blockchain is of an increased and more variable degree of transparency that could allow artists better optics into the nature of the flow and division of monies arising from sales of their music.

It makes sense then that when bitcoin came along and blockchain became a hot topic for conversation in the summer of 2015, putting the opportunities into a music context translated into some interesting potential. In this context, new models that seemed to offer greater control to artists in particular, if not rights holders more generally, started to become interesting to those who may or may not have been too hot at building large scale infrastructure solutions for an entire industry, but were very good at public relations.

It is perhaps not surprising that some of the most enthusiastic proponents of blockchain included music industry technology advocates and idealistic artists. The music industry establishment, meanwhile, in the form of major record labels and collecting societies remained interested but understandably perhaps a little more sceptical. In the course of writing this paper, I issued numerous requests to all three major record labels to field a spokesperson to answer questions on this topic, but to date I have had not a single positive response. Not that this should be taken as an indicator that there is no interest or research going on inside the major record companies. On the contrary, it would be fairly safe to assume that all three major labels are already spending money in to order to get a closer view of what if anything there might be to be adopted to their advantage in blockchain protocols. It might also be fairly safe to assume that, given the inherent characteristics of transparency in permissionless networks, the large corporate players are more likely to be attracted to the closed, permissioned networks.

As I began work on this paper, a number of events were taking place, which started to stimulate public discussion of blockchain in the music industry. Two of these events both took place on the same day, October 2nd, 2015. Prompted by the earlier publication of their report, *Fair Music: Transparency and Money Flows in the Music Industry*[19], Boston's Berklee School of Music, Institute for Creative Entrepreneurship, staged a conference gathering independent thinkers of the global music industry to discuss issues surrounding transparency and fair payment. The main outcome from this conference was an initiative to develop some kind of neutral open blockchain platform to capture global music related metadata. This is a project which Berklee is currently pursuing and is due to see the light of day during the course of this year.

The second event took place that foggy Friday evening at the Sonos Studios in Club Row in the heart of London's Shoreditch, Tech City area. The event was

packed and had the excited feeling of an occasion when something new and important was being revealed in public for the first time. Sonos Studios itself is smartly positioned in the heart of Shoreditch a stone's throw from the Google Campus (where many well know startups had been incubated), round the corner from Shoreditch House and the T-Building (where hipsters, digerati and music tech folk congregated socially), round the other corner from Brick Lane, home to music retailer Rough Trade East and the old Trumans Brewery complex home to many more start-up businesses. The studios by day hosts a small café and shared working space where jazz plays over the Sonos soundsystem and itinerant tech start-ups drink green teas and lattes while huddled around laptops wearing headphones for privacy. In the evening, the café turns into a bar, the tables are cleared away and the seats laid out auditorium style and there is a buzz in the air. People's heads turned continually to the door to see which famous people might be showing up for the event.

The meeting was held under the banner of the *Guardian Live* programme series. On the panel were Jamie Bartlett, Director, Centre for the Analysis of Social Media, at think-tank Demos, Imogen Heap, self-billed as Artist/Glover/Futurist, Vinay Gupta, Co-founder Ethereum Project, Alan Graham, Co-Founder OCL and Simon Edhouse, Managing Director, Bittunes. The debate was preceded by a launch performance of a new song by Imogen Heap, called *Tiny Human*, which was probably the first music single ever to be released on the block chain. Zoe Keating, a cellist and music activist based in San Francisco, who flew over for the night, accompanied Heap in her performance. Keating has become well known as an independent artist who has frequently questioned the nature and level of royalty payments coming from her various distributing labels and from digital service providers. She famously published extracts from her royalty statements, allowing a number of specialists to analyse just how and what she had been paid.

Later in an interview, Imogen Heap put the release of her single in the context of blockchain:

> *…I'm certainly the first artist to release music with a smart contract attached. There are other places which use blockchain, like the new distributed Alexandria Library founded by Devon Reed, Bittunes who allow buying and selling of music using bitcoin and Peermusic where the more profitable the artist becomes the more valuable their coins become*

so everyone shares in the profit. So there are lots of different models around. Ethereum is the platform I'm associated with, they have a currency called Ether. So for the first time a musician put up a piece of music with a contract attached that went into the blockchain. The contract set out that x% of monies should be paid to this person, x% to this person, and that was the first time that had been done for music.[20]

Heap has been championing the opportunities offered by blockchain in a developing series of interviews and articles, which appeared in *Billboard* and the *Forbes online blog* during the spring and summer of 2015. They were initiated by *Forbes* contributor, George Howard and preceded by an interview with Zoe Keating about bitcoin and the Arts.[21]

The launch event was also attended by Vitalik Buterin, the Canadian founder of Ethereum, who had flown in for the occasion. Vinay Gupta from Ethereum was there along with an audience of artist managers, music tech start-up founders, the CTO of Thomson-Reuters, and a number of heads of labels and independent music companies. The buzz was intense even if the content of the discussion a little hazy. I asked Imogen Heap what the reaction to the launch of *Tiny Human* on the blockchain had been:

It's been really amazing. Lots of confused looks. … Lots of people's views are: that sounds amazing, but it sounds impossible, sounds like it's too far in the future, that we don't have that technology now. But we do have that technology now. Everyone has the resources. We all have the way, but do we have the will collectively? It's so important that we try to encourage these people who do have these grand databases to open them up, to play their part in a bigger view and look to the future, because it's not the way to be closed and protective. It does not actually help our business.[22]

This meeting was followed by another equally well-attended meeting, in February 2016, when Heap launched her Mycelia Platform and set out a fuller vision for how the blockchain could create a new level playing field for artists. The growing level of excitement about the possibilities of the technology was firing people up. The Mycelia launch, which also took place at a packed Sonos Studios allowed Heap to share her views in more detail. She explained:

> *The level of understanding in October was very foggy. A lot of people had never heard of blockchain, but the speed of interest and understanding grew really fast. By January 2016, the buzz was out there, everyone had heard of blockchain even if they did not know exactly what it is or why it is relevant. But they realized that they need to come and hear about this and make decisions about how companies are being run based on this: are we going to be behind, is this a topic for our Board meetings, is this a threat or an opportunity?* [23]

Heap's Mycelia project, as she explains it, is an overall vision for how the music industry might take advantage of the technological capabilities that the blockchain allows. Her vision is more of a set of ideas about an architecture, based on her own informed and intuitive understanding of what the blockchain can do.

Mycelia is not a specific set of technological solutions or even a workflow although it may become one. At the time of writing, Mycelia is a fascinating set of aspirations and desires for how music and data might work under a new blockchain enabled architecture and what services they might translate into, in the foreseeable future.

Among the Mycelia launch attendees at the heavily oversubscribed February 2016 event at Sonos was another influential figure in all of this, Joseph Lubin. He is CEO of ConsenSys, a commercial offshoot of Ethereum. Lubin has a rich background in technology and finance, having started out as a coder, then worked at Goldman Sachs and subsequently developed his own hedge funds. He also had a period working in Jamaica with an artist whose career he sought to develop there. Lubin's New York City based company ConsenSys is developing decentralized applications (Dapps) across a very wide range of multiple sectors including financial services, insurance, and energy. They recently created a blockchain powered, distributed electricity grid in Brooklyn, NY, as well as pursuing ideas for music and film. It was through one of ConsenSys's subsidiary companies, Ujo Music, that *Tiny Human* was released on the blockchain.

ConsenSys is one of the key contenders among the growing group of new ventures looking to build fundamental pieces of a new musical eco-system. In many ways, their proposition is more fully fledged than others because of the fact that they view themselves, as Lubin puts it, as an Operating System

company. In a kind of spread-bet or land-grab, depending on your perspective, ConsenSys is assembling relevant generic building blocks which it hopes will be suitable for all kinds of business sectors at the operating level.

The flexibility of blockchain and the low cost of transactions on it, means that some of these companies are also developing new business models afforded by the decentralized architecture. Band equity and super-distribution are two models that seem to emerge with surprising frequency in these businesses. Band equity offerings essentially extend a small degree of ownership to the purchasing fan – usually to the rights in the particular track purchased. The promise is that the value of that equity increases if the tune becomes a hit. This leads naturally into a super-distribution offer in which fans are encouraged to sell or promote the music they have just purchased to other fans. Since they now own a piece of the tune, the argument goes that they will be motivated to sell on to others. Various different kinds of incentive scheme can then be modelled around how to reward that super-distribution activity. This is in some ways a fairly literal attempt to transfer the bitcoin mining model to the music industry. I suspect, however, that few people in music really believe that fans will respond to other fans in the way that this model anticipates. One of the key characteristics of fans that new entrants to music culture often fail to grasp is that financial incentives motivate fans far less than cultural credibility. This is a good example of the way that technology applications may appear in the abstract to transfer readily enough from the banking sector to the music sector, but in reality fail to take into account the immense differences in culture between them. Nevertheless, there are still businesses out there trying out these kinds of idea.

Bittunes, recently relocated to the UK from Australia, has assembled a number of independent bands from over twenty five countries who are trading music on their bitcoin- based platform. The company celebrates (suffers from) not being part of the major label system but also offers ownership of bitcoin as an incentive to buy the music. To quote the company's website:

> *The platform uses bitcoin as its primary currency, and both artists and music buyers earn bitcoin automatically as part of the platform's buying/distribution process. Although the community is relatively small, it operates as 'One Global Marketplace' for Music with 'One Currency' and uses only 'One Rights Framework'.*[24]

PeerTracks from Texas is also pursuing a blockchain-enabled super-distribution model, again unsurprisingly focused on indie bands that no one has ever heard of. A key aspect of their offerings seem to be that they allow the purchaser to end up with some currency which can be redeemed against fan club activities like meet-and-greets or signed merchandise. The PeerTracks currency is called "Notes" and relates in value to the overall fortunes of the band rather than being any form of actual equity in a work. PeerTracks is created by an entity calling itself the Bit Shares Music Foundation.Org. Based in Texas, the Foundation has just completed an auction, which seems to have lasted over a year to sell Music Notes, which are the format of their particular crypto-currency. The business has not yet surfaced from the preliminary auction phase, so it is hard to see the exact form that it is taking, although there is a detailed document available setting out the terms under which the notes have been purchased and may be used. At the time of writing, the PeerTracks website consists of a sign-up page to be alerted to when the beta launches and an FAQ. The site gives an explanation of how its Notes-based economy might work.

> *Being limited in number, Notes can rise and fall in value depending on that artist's popularity on PeerTracks. The more an artist is streamed, the more music he sells and the more he engages his Note holders, the more each one of his Notes can be worth. Not to be confused with equity – the fan does not own stake in a song, album, project, business or copyrights. Notes should be seen like fan club 2.0 memberships. The artist that created the Notes decides what he offers to his Note holders just as he decides what to offer to his fan club members – only in this case the memberships are quantifiable and tradable.*[25]

Another of the statements here about the nature of the platform they are building is that it also aspires to being the comprehensive solution for which everyone is apparently looking.

> *It is a Membership Organisation in the cloud that aims to be the foundation for the music industry's new ecosystem. It serves as a global database for copyrights, a means of payment for all music related transactions as well as a tool to simplify licensing of musical works. It provides artists with transparent accounting, automatically split up royalty payments and the capability to create their Notes so they can get*

discovered and engage their fan bases. Fans can interact, participate and even benefit from the success of their favorite artists! [26]

Although each company is trying to define its differentiating qualities, there are certain themes here to which people frequently return because they are derived from the way the technology works. The choice of using an existing currency such as bitcoin, or developing a new one such as Etherium's "Ether" or PeerTracks; "Notes", still begs the question whether any of these will achieve sufficient critical mass (among artists or consumers) to be commercially meaningful. Few folk in the music industry today can foresee with any confidence the mass adoption of a new purely music-related cryptocurrency by consumers If, however, a company like Consensys succeeds in its much larger vision of creating a digital environment across multiples business verticals in which a whole variety of services could be paid for in Ether, their digital currency, then perhaps music might find its place there. Whether music would be the lead vertical that delivers that mass adoption is the idea that Consensys is investing in and that many executives working in the music industry today would probably question.

At present, the closest prototype to something even recognisable to the mainstream has been Ujo Music's proof of concept launch for Imogen Heap's *Tiny Human* track. The language of Ujo Music's website reiterates the vision to which it aspires.

Ujo is a new shared infrastructure for the creative industries that returns more value to content creators and their customers. Our open platform uses blockchain technology to create a transparent and decentralised database of rights and rights owners and automates royalty payments using smart contracts and cryptocurrency. We hope that it will be the foundation upon which a new more transparent, more efficient and more profitable music ecosystem can be built.[27]

The refrain is fairly consistent. The rhetoric is very much about transparency, value and about empowering artists/rights owners to achieve new heights of efficiency. The opportunity that the technologists see is as broad as it is clear. As entrepreneurs, they see themselves as textbook disruptors. Simon Edhouse, Managing Director of Bittunes, was in an earlier part of his career an award-winning songwriter and composer in his native Australia. His passion and belief

in music and the appeal of music is what drives his entrepreneurialism. He sees himself as a true disruptor. Edhouse sees key differences between what he is trying to achieve in Bittunes and what some of the higher profile, industry insider players are trying to do.

> *They all want to dance with the mainstream industry. Bittunes doesn't want to do that. We want to completely sidestep the existing industry. We are interested in all the other non-major music industry music. The 99% of the real music that is out there.*[28]

As with the arrival of the internet, idealistic software developers could see more quickly and with fewer legacy obstacles to cloud their thinking, a view of how the music industry could be transformed. Whereas the free global distribution power of the internet, combined with the ease of mp3 as a compression solution rolled across the music industry like an unstoppable tsunami, blockchain's real potential seems to need more of the insiders in the industry to be involved and to adopt it, if it is to have as transformative an impact. There is a fine line to draw between the pure technology entrepreneurs who are interested in disruption and displacement, and those music industry entrepreneurs with inside knowledge who are more interested in transformation of the existing industry.

Artists arise! Join the blockchain not the chaingang.

As I have been writing this paper, musician/entrepreneur, founder of music crowd-sourcing platform Pledge Music, Benji Rogers, has been vigorously developing his version of a vision for how the blockchain could transform the music industry. While Imogen Heap found backing and support from Ethereum and ConsenSys via Ujo Music, Rogers' .bc project is backed by Monegraph, a media distribution company based in New York whose CEO is Kevin McCoy an Associate Professor in the Department of Art and Art Professions at NYU, where he oversees the department's digital art practices. Monegraph claims that it has a platform based on "patent-pending" blockchain technology, which can facilitate "secured media rights transactions with hundreds of specialized online publishers (websites, blogs, or subscription services)". 29 It is another kind of distributed network vision, which appears more rooted in broader media content than just music.

Benji Rogers has probably been the most active evangeliser of blockchain for music in the industry, since he started writing and talking about this in mid-

2015. Seemingly abandoning his duties as CEO of Pledge Music, Rogers set out to evangelise his vision and to expand on his version of ideas for a blockchain solution for the entire music industry. Unlike technologists who have the abstract application and vision in mind but no social network in the industry, Rogers was able to take advantage of his high personal profile and wide-ranging industry contacts developed through his earlier work on Pledge Music to attract an audience for his idea. He is a likeable character; his image of the amiable "muso-hipster" makes him an engaging presenter. He has given a considerable number of talks and presentations to music executives around the world, in London, LA, New York and Amsterdam and continues to add more locations every week. He has published a series of articles on *Medium*, the social blogging platform for essays, articles and journalism, setting out and expanding on his ideas.

Rogers espouses the blockchain maximalist view; the blockchain as *the* solution to all the music industry's problems all in one go. Rogers scheme combines an emotive not to say combative notion of Fair Trade for Music with the opportunities afforded by the blockchain. Into this familiar mix of hot buttons, he has also added the imminent growth of Virtual Reality as an additional market catalyst, which he argues could kick-start this new architecture. It remains a little unclear why it is that content created for Virtual Reality applications should be the particular catalyst for the .bc format, but there is clearly likely to be a lot of investment coming into this area in the near future. The development of the 360-degree Virtual Reality (VR) goggles and other similar hardware, which manufacturers hope will be the Christmas present of choice in December 2016, are likely to drive demand for new content. Music may find some incremental revenues from this new area of content creation, but it remains unclear if this requires the development of a new 'codec' as Rogers asserts. To the extent that VR is likely to attract new streams of investment, then this represents an understandably fertile hunting ground if what you want to do is fund a new project. Rogers' proposals are rapidly evolving and understandably fluid at this early stage; even within the period of my writing this they have evolved. Initially his ideas included the development of a new codec, but subsequently (between my first draft and the last), he has amended his concept to something that is more of a new form of wrapper or container file format for music content.

Rogers points to the lack of transparency in current artists' royalty distributions. He points to the failure of the music industry's most recent large scale data

project, the Global Repertoire Database (GRD) and he highlights the poor level of payments that artists receive from labels for royalties from digital streaming services.

Like Imogen Heap, Rogers has been holding forth at packed meetings with the febrile atmosphere of a revolutionary cell. Rogers' event, on February 1st 2016, which was also attended by Imogen Heap was neatly timed between her two Sonos events. The meeting that night was held in the rather formal and somewhat unlikely surroundings of the BPI's main board room where on other occasions the BPI Council, made up of the heads of the major records labels and larger independents sit to determine policy for the established music industry. The audience was neatly divided between mainstream sceptics and enthusiastic idealists. In the crowd were many leading thinkers in the UK music industry, including BPI CEO, Geoff Taylor, Sony Music strategy chief, Federico Bolza, and Scott Cohen, co-founder of independent distributor, the Orchard (now owned by Sony Music).

Rogers' premise for his vision is focused on the lack of a Global Repertoire Database. He set out his basic position (this is from the most recent project presentation that I attended):

> *There is currently no efficient way to track music rights, ownership or payments globally*
>
> *A global database of rights, ownership & rules would help/fix a lot of the current problems related to the distribution of payments*
>
> *A global database of rights & ownership rules has been attempted and has failed*
>
> *A blockchain Distributed Ledger seems like a great place to build a global database of rights, ownership & rules*
>
> *Getting all of the songs into a single traditional database let alone a blockchain is really hard to do*
>
> *Back Catalogue challenges/Fractured ownership*
>
> *Who would do it?* [30]

In answer to his own question, Rogers' idea is to convene a consortium of representative members across all sections of the industry, which would act as the authorising and supervisory body to establish and implement his vision. The

simple appeal of Rogers' proposal is that a GRD could be created this way incrementally.

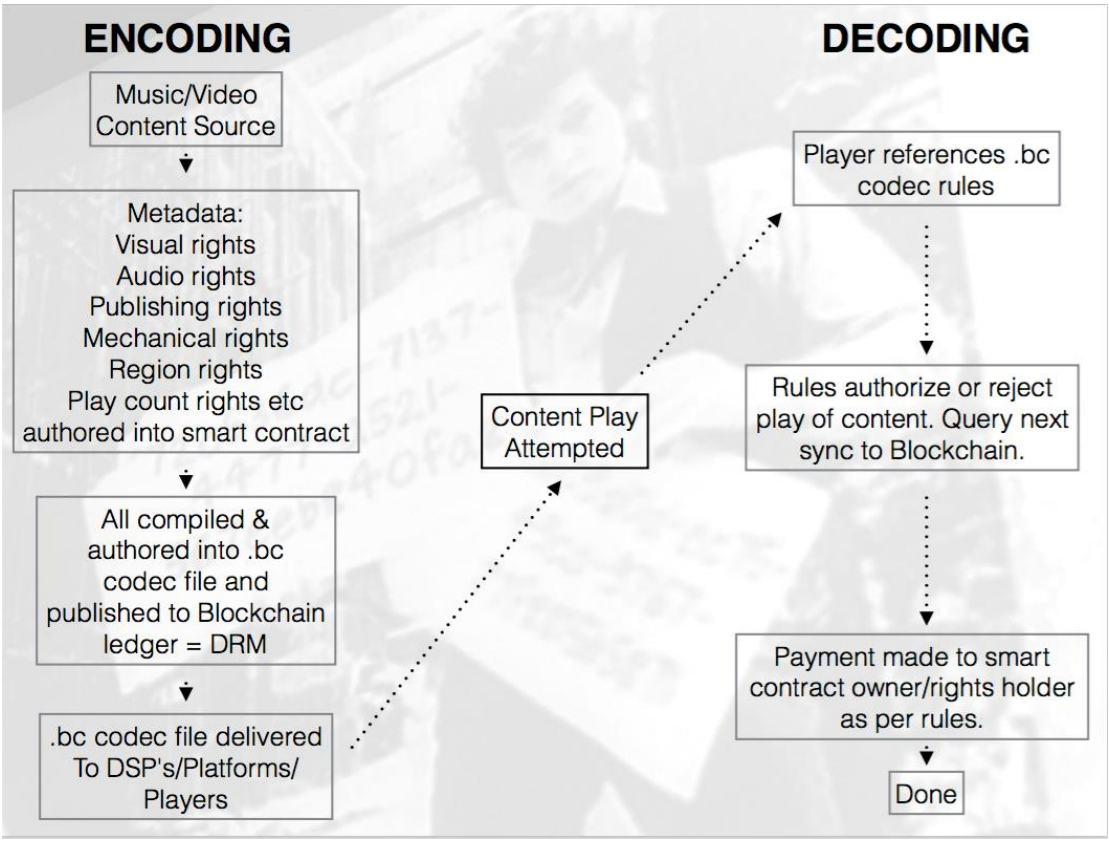
> *The idea is that each dataset added about each track to the blockchain will also be added to a global database... Each dotblockchain file builds and then adds to a global decentralized database of rights. The data-set at its core is unified. Just by being submitted.*[31]

Rogers goes on to describe what he terms a Minimum Viable Dataset (MVD), which he envisages would comprise:[32]

- *Complete Ownership Info*
- *ISRC/ISWC/ISNI*
- *Publishing Information*
- *Mechanical Rights Information*
- *Performer Information*
- *Global Licensing Rules*
- *Usage Rights*
- *Lyrics/Images*
- *Payment Information*
- *Contact Info*

This is an attractive idea, but it skirts over the fundamental challenge with which current collecting societies grapple. If Rogers' MVD were all that were needed then the collecting societies could have done that long ago. The problem is that in a global market place, complete ownership information is a highly complex and often changing matter. Sub-publishers, distributors in different territories, multiple song-writers with their various associated sub-publishers in different territories all make for a highly complicated set of rights holders in more than a minority of situations. By the very nature of the industry, commercial success brings on commercial complexity. Rogers' scheme might work for new releases going forward and, to be fair, that is mostly his focus. It does not address how to manage the legacy of existing catalogue and its associated meta-data which at any given moment is where the bulk of business activity remains.

His next steps set out a workflow of how, as he saw it in early 2016, the architecture might function as an end-to-end solution, including the audio content itself.[33]



There are many who would immediately question whether the meta-data and the audio content need to be bundled together in the way Rogers proposes to make this work. Others might question whether blockchain as currently configured could actually cope with files containing the audio itself. Inevitably, there have already been numerous iterations of this workflow. In particular, this presentation got quite a strong reaction to the notion that Rogers was seeking to reintroduce the concept of DRM into music transactions only a few years after an earlier generation of technology reformers, such as himself, had been extremely active in trying to get so-called "technical protection measures" removed. While Rogers appreciates the irony, adding the transactional security is key to what blockchain does. That has to be one of its key selling points.

Rogers was getting a lot of attention for his presentation. Certainly, this was the first time in a very long time that so much industry executive time had been given to such a wide-ranging architectural proposal for the entire industry. Within that of course, he received both positive reactions as well as the scepticism that one might expect. As he explained it, again at the BPI, on February1st 2016:

> *We have to start with a kernel of truth, a core of data. A lot of the new solutions out there call for the tearing down of the existing system and destroying it all. But what I've said is resonating across the whole ecosystem. Artists, digital service providers, performing rights organisations, lawyers, musicians, fans have reached out and asked how can we be part of this? This adds up! This is about creating new rules that allow new uses that have not been worth licensing before.*[34]

Capturing the metadata needed to build a GRD and enabling some new forms of licensing that had not made sense commercially, previously, are two quite separate approaches, which Rogers seems to elide here. His last point clearly does resonate with the more pragmatic folk in the commercial sector. If Rogers' .bc scheme could reduce friction in, for example the licensing of user-generated content, which is currently deemed too expensive and too difficult to be viable, then there are more likely to be interested parties than if he sought to reform completely existing revenue mechanisms. Actually, of course he is trying to do both – maybe using one to achieve the other.

The greatest obstacle to Roger's scheme is gaining sufficient buy-in to encourage investors to take a risk. The presence of new entrants like Consensys and Monegraph do potentially allow for prototype platforms to be inexpensively created and for registrations to be solicited. But for something to develop that goes beyond being an experiment in previously un-monetised areas, then a critical mass of meta-data contributors will be required. It is hard currently to see that any group of stakeholders is experiencing sufficient pain to incentivise them to contribute. Independent artists are the most likely group, but even for them, contributing their meta-data to a blockchain platform would still be an additional burden on top of whatever sales, marketing efforts they are already undertaking. If Rogers is to succeed he will be hoping to attract some deep-pocketed investors to help him create more traditional incentives to attract artists onboard at scale.

One Click Licensing (OCL), a new company co-founded by veteran music producer Rupert Hine and technologist and author, Alan Graham, seems to be taking a similar approach. The company has developed a platform that enables low traction, micro-transactional, instant licensing. Although not formally announced at this time by the Performing Rights Society (PRS), Graham Davies, their head of strategy, explained the collecting society's thinking.

> *If, for example we were able to create an app that enabled people to synchronise music from their collection with videos and artwork and then be posted onto YouTube and other platforms, there could be lots of new uses there. This would be a new opportunity to synch music into a new piece of media that could then be syndicated across lots of platforms, each of which we could license to use these new products. This is one potential application and we are planning to do something like this with OCL. By doing this we will start to learn what kinds of issues arise.* [35]

It seems eminently sensible to start with this kind of low level incremental licensing scheme. It is less disruptive and all upside. Rather than trying to change what arguably already works, OCL is offering the prospect of newfound money. This looks like a smarter way to convince a collecting society to put its toe in the water and make itself look a bit progressive in the process.

We will discuss the collecting societies in more detail further on, but it might be useful first to draw a few distinctions between the different visions emerging here. We have the digital currency folk (Bittunes, PeerTracks, Ujo) who tend to come from a pure technology perspective and are therefore drawn to the business model opportunities afforded by cryptocurrencies. Then there are the industry visionaries looking for a better deal for creators. There are a few differences in approach here between the recording artist, Heap, and Rogers, the entrepreneur.. Heap's approach is more the artist's vision, as it should be. His appears more practical and is considered from the point of view of a technology workflow, although arguably it has just as much romance to it as the artist view. Heap is quick to emphasise this difference between Rogers' proposals and her own Mycelia project. As she pointed out, at the BPI event February 1st 2016:

I wasn't thinking about this as a format, but more of a way of setting some ethical, cultural and commercial standards for how you could use all these different pieces of information.[36]

As Heap explains, this includes ensuring that an artist is paid in a near real-time fashion for the consumption of their content via a digital service provider (DSP) rather than it taking months or even years for a payment to be processed either via a collecting society for publishing or via a record label for the recording royalties. In an interview in February 2016, Heap explained further:

One of the key things is about easing up the flow. We have flow going to the fan – like on Twitter and Youtube – music can go straight there in a nano second, there it is. But we don't have the payment back and the data back. Currently the flow back of payment and information is incredibly slow and that's where the disruption could really take place. So we want to focus on how to make that return flow just as quick and useful for us as it is to the fan.[37]

Similarly, Heap has a view about the way in which data could be more effectively marshalled and made visible in blockchain. For her, the openness of this data would be key to its becoming universally available for brands and marketers to exploit. As well as capturing standards levels of data of the kind that Rogers sets out in his Minimum Viable Dataset concept, Heap is looking beyond that to including previously unrecorded kinds of data. At the February 2016 BPI event, Heap said:

Another thing is that I want to share all the information to enable developers and people building music platforms, to be able to say "Here's some stuff." Anything from who produced it, what sorts of instruments are played on it, what the song is about, what key is it in, what tempo, what time signature is it in, where I wrote it, what brand of instruments did I used, what coffee was I drinking, what was I wearing?" I'd like it if all this could get into the system – as stuff that goes with this song that can be shared. You would not just have a song and a video, but all the people involved – what was that instrument, where was it brought from? There are so many things that go into a piece of music that don't get shared, that I as an artist would like to see made public. Imagine if a brand could

start to ask questions about this kind of data? Imagine if there was just a massive database like that which anyone could search. [38]

This is a wonderful and interesting extension of the current vision for data collection in the industry. It acknowledges the need for an intrinsic link between the metadata to describe every aspect of the way an artist monetises their artistry today. It recognises, for example, that brand sponsorship is as much a part of the artist's business model today as intellectual property rights exploitation. It also demonstrates the degree to which existing metadata institutions in the content industries are less than fit for digital purposes.

Equally, Heap displays a remarkable sense of responsibility for the creators of musical heritage. I suggested to her that in order to pull off what she is proposing, we might have to draw a line in the sand and start somewhere going forward, but not try to handle the legacy of old catalogue. Heap responded quite forcefully:

If we said that about the past though, that would really be letting the artists and the musicians down; all those people who worked so hard on all those old tracks and had far worse deals than any of us today. So we have to work out how to bring their revenues out of the sludge because they are our forefathers. They are the ones who got us to this point of relative fairness compared to their times. Plus there is not that much music from the past compared with how much music is being produced today. Relatively, the records of the past in total do not in data terms represent that much of a mountain.[39]

Although it may be expressed in romantic language, Heap's words have a profound importance. In fact, as we shall see, collecting societies currently devote considerable time and effort to precisely the project to which Heap refers; trying to identify accurately performers and creators contributions to works and recordings.

Heap is being more radical here too. Her argument and I entirely support this is that it should not be a matter of trade secrets as to who wrote what song or played on what track. When Rogers discusses a Minimum Viable Dataset, I would argue for a Maximum Viable Dataset. If we can all agree that everybody should be able to know the name of a song and the performing artist, then why

should we not also know the names of the songwriters and of the musicians performing the track, who the producer was or who the engineer was? Or the mastering engineer or the studio it was recorded in and on which date? And if you extend this logic further back into the business side, why should it be a trade secret who owns the UK or the Scandanavian recording distribution rights or the publishing rights or the Estonian sub-publishing rights? These should not be trade secrets, they should be in the public domain and putting them there would instantly increase the ease of licensing and doing business generally across the industry.

It is largely the vested interests of those that have created and maintained the different subsets of all this data that prevents its publication; that and the fact that they do not agree on some of the detail in the information. We shall see in the next section how some efforts have been made to try to bring the data together and reconcile those differences, but so far there has been little sign of any interest on the part of the industry to make this type of data public. Curiously, although the metadata exists in various forms across the industry, it is only in the databases of niche start-ups (such as Musicbrainz, WhoSampled, and Quantone) who have generally crowdsourced this kind of information that it can be publicly accessed.

So the question remains will blockchain technology act as a catalyst to unlock this data and the new services that could flow from it? Will compulsory licences from government force its publication? Time alone will tell, but the blockchain discussion as it coincides with other emerging industry issues, is pushing the agenda along.

One pill makes you smaller: collecting societies and validation problems

In many ways this issue of data transparency is where the rubber hits the road for the collecting societies and individual artists. Whereas every artist has his or her own deal with a record company, the deal with collecting societies is the same. Although, in theory, collecting societies are owned by their members, there is a sense in which the executives who manage these large organisations operate at a level which their members may find it hard to influence.

Will the blockchain be a pill that allows collecting societies to grow smaller and more efficient? In their visions, the maximalists see blockchain taking over all the functions of collecting societies and rendering their services almost completely unnecessary. They see that the blockchain could enable the implementation of smart contracts able both to collect and distribute rights in almost real time according to whatever pre-agreed rules have been put in place by the rights owner. They see that the analogue requirement to manage such things as broadcast revenues on a blanket licence basis will eventually in a fully digital world move to payment on individual transactions (e.g. payment per radio play). Their visions rise above all the concerns around the distribution of blanket licence revenues, of delays in the transmission of international monies, of opaque distribution of non-attributable revenue across memberships that ends in the largest rights owners making the largest gains. Not surprisingly, from a 20,000 feet view these kinds of challenges easily disappear in the face of a technology that can conquer all. On the ground, however, the nature of the current business of negotiating, collecting and distributing royalties accurately is increasingly challenging. As digital services release increasing quantities of data on collecting societies, their legacy systems are less and less able to handle those levels of granularity. So there are challenges to face.

Collecting societies are also under increasing pressure to reduce overheads, become more competitive and more transparent. This pressure is coming from all sides, rights owners, creator members as well as from licensees. In Europe, the EU Copyright Directive is specifically targeting Collecting Societies to encourage them to do what many of them see as slightly contradictory things. On the one hand become more transparent and efficient (which probably

involves working more efficiently together across numerous territories), while also becoming more competitive with one another.

When I asked the CTO and CEO of PPL how they might find a use for blockchain in solving some of their current issues, they were quick to jump to the very basics of getting clean metadata and reconciling against other data sources which remains a massive headache for many collecting societies around the world. One small part of that problem, for PPL for example, is the question of how to achieve correct identification of contributor line-ups. This is not just a matter of garbage in garbage out. It is a question of tracking down previously unrecognised contributors or managing the claims of contributors who pop up out of the blue. These are not the kind of circumstances that are anticipated in standard financial services transactions and highlight the challenge of too simplistic a transference of technology from one domain to another.

Mike Douglas, PPL CTO, was quick to highlight the challenges.

> *Our effort is all about identifying a performer's, details, eligibility, and status for collecting in a particular territory. I like the democratising principle that says if enough people say something is true it is deemed to be so. If blockchain were able to enable this kind of democratising function of validating information, then that could be helpful. A blockchain based system for engaging with orchestras could be interesting. E.g., John X played tuba in orchestra Y in July of this year. There are six people here on the blockchain saying say so and no one disagrees. If we were to engage with many musicians and session players this way, we could make this quite slick, we could deliver it through mobile devices and people would be motivated to engage with us.*
>
> *But this kind of thing is not without problems. If, for example, we were to adopt a blockchain type solution for repertoire registration, the problem is how do we stop some guy in Scandinavia who has a non-exclusive distribution licence for a single track claiming he owns it in our database? How does blockchain stop them? Currently PPL has a dispute resolution process to handle this situation. I'm not sure that the blockchain would solve those sorts of issues.*[40]

In fact, there are companies trying to address the challenge of capturing identity at the point of creation. Swedish company, Auddly AB, is creating a system by which recording studios and content creators can capture and attach contributor identity metadata to the files of master-recordings. Yet, they are not using blockchain to try to solve the problem. In fact, industry workflows can be quite opaque as, Graham Davies, at PRS, points out:

> *A session player doesn't necessarily know whether what he played ends up on the final mix. I'm a producer who creates three remixes, but I don't know which one the label might choose to release. Equally, the label may not know who originally contributed to what track, by the time they get to decide which to release.*[41]

This issue about the resolution of disputes over identity and contributions becomes the shared refrain in both PRS's and PPL's views of blockchain. It is a concern governed by the large volume of back catalogue that generates the majority of the revenue, which the societies administer. While the innovators point optimistically to new blockchain mechanisms by which data might be incrementally authorised and validated as and when new content is created, the incumbents are all too aware of the imperfections of their current system and data.

Crowd-sourced validation of the identity of a transacting buyer or seller is rather more straightforward in financial services deal than it is in the world of music rights and intellectual property where it relates to less binary matters such as rights ownership, territorial definitions and probably hairriest of all contributor authenticity. Who did exactly play second violin on that song? Mike Douglas continues:

> *My concern is that in a blockchain world of crowd sourced validation, no amount of crowd-sourced validation would spot that this has been registered as a new rights holder when they're not. We have layers of review, reporting and analytics that help us capture these things. You have to ask how would that happen in a crowd-sourced world?*
>
> *Here's another example: we have a troublesome performer who claims he performed on a particular track. He gets his sons and other family members to validate his claim even though he didn't in fact appear on the*

track. A democratising model would get three or four people all saying that this guy did indeed perform on this Donna Summer track when he clearly did not. Who is ever going to pick up on that? And who knows the truth?

Having said all that, I still really like the idea of tapping into the crowdsourcing opportunity. It costs us a lot to do this kind of checking. There are some very knowledgeable groups out there, Decibel {recently renamed as Quantone}, Gracenote, WhoSampled, etc. Why would we not benefit from the kind of data that they can share with us? I'm certainly not going to replicate what they're doing.[42]

These are clearly issues that would be hard to automate retrospectively. There does, however, seem to be a degree of blurring of understanding here, between what might take place digitally on blockchain and what might be more of an analogue, people-based kind of crowdsourcing. Douglas picks up on the idea of blockchain as some kind of validation engine, while ignoring many of the other characteristics of the technology, which might be beneficial to his performer members such as its inherent security and transparency.

In the bitcoin crypto-currency world, the validation of transactions is carried out trustlessly and anonymously by so called miners. Mining is explained in lots of ways by its proponents and is a sophisticated solution to a relatively simple problem[43]. Essentially, mining is the system the bitcoin network uses both to issue new bitcoins into the system and to validate transactions. Transaction validation ensures that the same money is not used to pay for two things at once, that the purchaser is good for the money and the vendor is correctly identified. This demands a degree of transparency but also enables total trustlessness in the transaction and total anonymity. This is very handy for currency transactions, particularly the illicit kind being carried out in its Silk Road past. It has also a general value in legitimate transaction validation too. For PPL, this application of bitcoin is of less interest. From their perspective the challenge is less about how to improve how they currently distribute, but more about how to render more accurately what they distribute and to whom.

So while it may be something of a simplification or a misreading of mining to understand it as a form of crowd-sourced problem solving, it does seem clear that adding blockchain on to existing collecting society systems in any simplistic

kind of way might be stretching the technology beyond what is can most usefully be used for. Bitcoin mining is highly complex and brilliantly conceived as a method to validate transactions. It is unlikely to work for retrospective music performance contribution attribution. Even if the music industry were to adapt aspects of blockchain, mining in its current form is unlikely to be used in anything other than what it was designed for, transaction validation. Graham Davies of PRS observes:

> *On the current blockchains, it seems that most of the transactional validation that takes place, by miners solving complex cryptographic problems, is not about the basic questions of ownership or make-up of performer line-ups. It's about whether or not the transaction happened and whether buyer x or seller y had the cash to do the deal. It's not about whether the thing that one of them is selling is correctly theirs to sell or who else might have a claim on it.*[44]

The economy of music rights, just like any other economy, is beset with its own specific challenges and with those who deliberately test authority in the system. PPL's CEO, Peter Letham adds a realworld perspective:

> *You have to guard against abuse from, for example, a group of session players who played together on a lot of tracks, suddenly claiming to have been on a bunch of others and validating each other. We found a company that seemed to be set up to do just that and we had to stop it. So whatever you try to do, people will always try to game your system and we have to be vigilant against that.*[45]

Clearly this kind of problem exists in other contexts even without any intent to defraud.

Professor Burkhard Schafer of the University of Edinburgh takes the view that, in a fully digital world, validation of entries and dispute resolution may be more easily resolved by a kind of integrated dispute resolution. In a recent discussion on the topic, he said:

> *Misattribution becomes less common through online collective activity – à la Wikipedia – also due to there being sufficient numbers of online sources for the data to be cited in, to validate against. The purely*

digital domain does make more feasible this approach because of the ease with which one can monitor and document activity online.[46]

The solution providers do move rapidly to a vision of an entirely digital environment in order to demonstrate the usefulenss of their ideas. Joseph Lubin at ConsenSys conjures up a very futuristic view of how, on his blockchain platform, the problem of identity might be overcome in the fully digital world of the cryptocitizen:

We are building, Uport, a reputation system. [It] will give every person on the planet who wants to use it, a persistent portable identity and reputation. And so people will be able to interact in different business and political contexts from an idea of a representation of themselves that has some sort of community trust associated with it. ... Banks or the postal service can register a reputational attestation on that reputational attribute that is your State issued ID. Other people can attach a reputational attestation based on different kinds of transactions. So our ether poker system, our prediction-market system, our music platform, various other properties such as an open Amazon-like market; all these things will have local reputation systems that people will have attached to the conduct of counter-parties in purchase or sale transactions, in letting, borrowing or repaying, or just in playing games together.[47]

Certainly in the context of the challenges of trying to identify session-musicians from 1960s recording sessions, these kinds of crypto solution may seem far removed, but as we progress into an increasingly digitised future, Lubin's vision as set out here is a model of what may well become a practical way forward. ConsenSys is obviously hoping that as it spreads its bets across a number of different domains, mass adoption of its system would put it in a strong position. The tumble and flux of music creation and production may or may not turn out to be a good early adopter of Lubin's vision for digital identity and reputation, but he has his own reasons for wanting to make it work in music. As a one time hedge-fund owner, Lubin will surely be as ruthless with his triage of businesses when the time comes, as he has been in letting a thousand flowers bloom to start with. So if it works in music for him then all well and good, if not, he will no doubt find other opportunities developing in insurance or energy.

The fact is of course that, as ever in the world of technology transfer and adoption, the perspective looks very different for incumbents than it does for new entrants. The executives of PPL and PRS have made it clear, for now, until they find can better, convincing, scalable solutions to the problem of authoritatively defining creator contributions and performer line-ups, manual investigation and individual judgment still seem more likely to produce an equitable outcome.

Some might ask whether they have their priorities right in the degree to which they are focusing on fulfilling the current remit as well as possible, by trying to ascertain with certainty whether a particular musician played on a particular track, recorded in some by-gone era, rather than focusing on the future technologies and architectures of collection and distribution. They would argue that they are big enough to do both and that both are priorities. For the representatives of catalogue artists, these kinds of manually researched solutions will certainly continue to be needed.

There is little question that our future is one in which digital identities will be developed for us and in which digital networks increasingly drive society, politics and the economy. In that future, the particular contribution made by a music creator, publisher, master recording rights owner, etc., looks increasingly likely to be validated by digital registration of some sort. Whether it is on blockchain or in some other kind of digital registry, like Auddly's, remains to be seen. At least these kinds of ideas hold out the hope that music rights businesses, labels or collecting organisations will become more efficient, the more digitial they and we all become. The question is will the new injection of resource and ideas from technology entrants into the music industry be well received by businesses, artists and collecting societies or will they respond by slowing things down for as long as possible. Given the political climate in the US and in Europe, collecting societies are being urged to take more progressive steps. One such step might be to become a good deal more active in their exploration of the capabilities of blockchain to increase their efficiency in data gathering, identity validation and in transaction handling.

Towards a Global Repertoire Database – the race is on again

The challenges for collecting societies across the globe include not only verification of individual contributor identity but also establishing overall integrity of metadata within single systems and between discrete databases. It is no

secret that collecting societies have incomplete and inaccurate metadata. As we have seen, despite valiant efforts, there is still no Global Repertoire Database (GRD), no single global authoritative source of data on who owns the rights in which published and recorded musical works. There are many approximations, which have been developed by the collective management organisations set up by rights owners in their particular sectors and in their particular territories.

The multiple ownership of rights by function, territory and sub-agreement has created a meta-data mess of pottage that is proving very expensive and difficult to consolidate. The efforts of music publishers to nurture writers and composers and promote them aggressively combined with the record companies' desire to sign performers and artists competitively, has fractured the industry into a myriad of rights owners. We have witnessed intensification of fine slicing of intellectual property since well before the growth of the internet. Scheduled broadcast radio, TV, on-demand, on-line, stream, or download rights; all are sub-divisions of basic master rights in publishing, recording and performance. The economics of the analogue world encouraged this fine slicing. Different countries distinguished themselves by significant differences in their copyright legislation.

Digital systems, however, are no respecters of geography; they thrive on efficiency, transparency and friction-free environments. The pain of digital transformation for content businesses is not just about the changes in consumer behaviour, it is also about the fundamentally altered intellectual property environment that digital demands. In an increasingly programmatic digital environment, and one persistently eroded by a fairly constant degree of piracy, the more efficiently rights can be licensed, it is argued, the more likely a transaction is to occur. This applies both to the bundling of pan-territorial rights that the EU is pushing for across its Single Digital Market, but also to the desirability of re-assembling publishing and recording rights more generally in the digital domain.

There are numerous concerted efforts to try to overcome some of these problems. PRS (UK) and STIM (Sweden) have collaborated with GEMA (Germany) to create International Copyright Enterprise (ICE) which is an effort at cross database alignment between the data sets that they control. The cleaning and reconciling of this music publishing data has been ongoing for ten years. ICE is now beginning to yield significant dividends with the announcement

in June 2015 of EU approval for the development of a licensing hub based on the newly consolidated repertoire databases of the three participants. While this looks like a positive incremental step in the right direction, it also highlights the degree to which the music industry has long suffered from the fundamental lack of a shared global database.

In 2014, despite concerted efforts over several preceding years, the project to create a Global Repertoire Database (GRD), in which ICE was a key player, finally collapsed. The industry was quick to express its own dissatisfaction at this failure. In July 2014, Andy Heath, Chairman of UKMusic published an op-ed piece in UK trade journal, *Music Week,* urging the industry to unite around this disappointment and find new ways forward. Given a degree of self-flagellation, which suggested that the leadership of the music industry was very disappointed in its inability to get its act together, I was interested and weirdly relieved to find during my research, that the music industry is far from alone in this situation. Professor Mainelli explains:

> *In the insurance world centralised third party initiatives repeatedly fail. So, for example, Line, Electronic Placement Support, Kinnect, currently eBix and PPL, are all projects in the central market here that have failed. They fail because everybody realises at some point that it's not in their interest to give a natural monopoly on data to the group who propose running the new project.*[48]

Mainelli implies that the nature of collaboration around centralised solutions is that they engender this kind of mistrust. Power invariably moves to whomever it is who shapes up to have central control of the database. This, he argues, inevitably results in one party or another destroying the project overall as the shift of power becomes too obvious. This is why he is such an advocate of distributed ledgers and blockchain-like solutions and why, perhaps there is a chance that the industry too eventually recognises the long term value of achieving a truly distributed global repertoire database which might actually make more money for more people, more equitably, than it cost to build.

Sadly, it seems almost inconceivable at present to imagine the industry being able to go beyond this and find a means to hold in one place all the data associated with an artist – such as the availability and rights ownership position of all their digital products as well as all their physical assets such as CDs, vinyl,

merchandise and live performances – let alone the advanced, extended data-set that Imogen Heap imagines.

Failure in centralised systems becomes a lightning rod for those that advocate decentralised solutions. The failure of the GRD was one of, Consensys CEO, Joseph Lubin's targets when he first began to make his proposals for a music industry blockchain solution. In a 2015 blogpost with the carefully chosen domain name *.wtf,* Lubin neatly framed the problem. He described the GRD as :

> *1) an attempt to arrive at a new solution without addressing the structural limitations of the incumbent system and*
>
> *2) a centralized approach that requires a utopian level of consensus among stakeholders with differing and often conflicting perspectives and goals before it can succeed and doesn't incentivize individual stakeholders to make the first move.*[49]

Lubin's analysis of the nature of the challenge is cogently expressed. Of course it is offered as the rationale for his alternative solution, in the form of Ujo Music. So far, however, while I certainly agree with Lubin's first two points, I have yet to see anyone come up with the right kind of incentives to encourage stakeholders to make those early moves.

What nearly all the blockchain challengers propose is dependent on incremental population of metadata on a blockchain as each piece of content is made available or as each transaction takes place. As well as being less likely to be sabotaged by key players because of its distributed nature, the other attraction of this approach is that it would be much more cost effective than attempting the super high cost, super labour intensive one-off task of building a GRD whose value would only start to be returned once it was complete. Yet it is still hard to know why anyone would start to do this unless a critical mass of rights owners or artists started simultaneously as part of an agreed movement to get something started.

Creating a GRD for the digital age seems to be shaping up to be an interesting competition. As more players enter the blockchain conversation, the more they all recite the need for structured data to sit at the heart of any fully digitised content industry. Yet to do this does not require the blockchain. Several incumbent digital players have already intervened to take their own steps in this

direction. Google, via YouTube and its ContentID system, are perhaps the furthest along the way. ContentID was designed to help Google identify and validate rights holders claims to any piece of content so that take-down requests for unauthorised postings could be validated as well as revenue shares for advertiser paid content. As the project has developed, it has been refined by the daily contributions of metadata by rights-holders, motivated to protect their own content from being used without a licence. ContentID has yielded a kind of GRD by default, assembled initially to protect rights from wrongful use and subsequently to monetise them.

Observers have noted the financial stake recently taken by Google in Kobalt, a music rights management technology company, which might indicate an ambition to bring together the extensive database of publisher rights information held by Kobalt with the ContentID data held by YouTube. Between them, Youtube and Kobalt are well down the road to creating something of substance in their own incremental fashion. Kobalt CEO, Willard Ahdritz said in an interview in *Billboard*, the US trade magazine, in April 2015:

> *Every month Kobalt monetizes 1.5 billion videos streams on YouTube alone in the U.S. We match over 1.8 million videos using our clients' content every month. I'm a little surprised that the industry as a whole hasn't done more in this area because if you don't match your catalogue, you don't get paid. These are the fundamental challenges that the industry faces. The pipes are broken and the infrastructure is not there to support that half a terabyte of data per month generated from just one DSP.*[50]

A YouTube Kobalt combination could potentially produce something closer to a truly global repertoire database than anyone else has managed so far. In a meeting at ATC Management, Managing Director, Brian Message pointed out the nature of the competition and asked a not entirely rhetorical question:

> *Would you need the blockchain if someone else, e.g., Kobalt, offered to deliver super-fast accounting, wholly transparent, globally distributed, real time micro-licensing of music content solution?* [51]

Yet, if industry history is anything to go by and if Mainelli and Lubin are to be believed, as ambitions like those allegedly harboured by Google and Kobalt

become more developed and more visible, those who today contribute their data happily on an incremental daily basis to these third-party centralised systems may feel the need to end up sabotaging those projects, in similar ways to the major publishers withdrawing rights from the collecting societies over the last few years, albeit for ostensibly very different reasons.

Whether it be Rogers' .bc, Heap's Mycelium, Ujo Music or indeed any other new entrants yet to rise from stealth mode, the blockchain does appear to offer a genuinely democratised path to the creation of a GRD. Anyone looking at the music industry today knows that for it to complete its digital journey, it must eventually see the creation of this kind of data architecture at its core. Historically, however, the music industry has not been known for its willingness to agree on globally applicable standards and then stick to them.

In the midst of all this, and with some recognition of these challenges, there is one other possible route to achieving the GRD goal and that is being proposed neither by music industry executives nor by new entrant technology companies, but by music-related academics. In a move to try to develop a shared set of industry standards for core creative metadata in the blockchain, the Berklee School of Music's Institute for Creative Entrepreneurship, led by CEO Panos Panay, is spearheading a new set of music industry metadata standards and protocols, called The Open Music Initiative (OMI). Panay has a background in the live side of the music industry. He was founder and CEO of Sonicbids, a company that charges fees to match bands and gigs. He was also the organiser of the ReThink Music summit mentioned earlier, and the publisher of the Fair Music Report in October 2015. The outcome of that work is a new effort to bring together a consortium of advisers and representatives from across the industry that might help generate an open set of metadata standards and protocols for blockchain for music, which could in turn be used by any of the start-ups, incumbents or new entrants contributing to this space. The OMI is in its early stages at the time of writing and will be something to watch as it develops in coming months and years. There are of course a number of other initiatives that are already well established and frequently used in this arena, such as Musicbrainz, Discogs and DDex. Each is different and attempting to solve slightly different parts of this overall problem. All of them could feed resource into a blockchain agenda, if that turned out to be the catalyst that brought about faster or more widespread change in the industry.

One final note on the blockchain and the collecting societies; in reviewing my interviews with strategists at the collecting societies, it was interesting to find that their conversations focused mostly on the perils or inappropriateness to them of the permissionless model and hardly at all on the closed, permissioned variety of blockchain. That was perhaps because many of their comments were in reaction to the huge amount of publicity within the music industry that Heap and Rogers have attracted. The conversation has been skewed towards the creators' agenda. It is, however, worth recalling, as I mentioned earlier, that currently most of the blockchain investment by the international clearing banks is into how they would use permissioned systems. These kinds of systems are the ones most likely to be used by market incumbents who have plenty of obvious interest in preserving confidentiality and closed systems. It is for this reason that a challenger business like ConsenSys, boasts both the open innovation, developer platform (their permissionless instantiation of the Etherium blockchain) and a professional services, consulting business aimed at corporates, which could specialise in developing permissioned networks for internal use or closed use between numerous selected partners.

There do seem to be opportunities in permissioned systems that current collecting societies and indeed major labels or publishers) could and should explore. The benefits of adopting this approach are likely to come more slowly and offer more incremental return on investment. Graham Davies of PRS observed:

> *There are a number of implementations of blockchain which could be of interest as improvements on our current model. There are also those that say ignore the current model and let's start from scratch. If there were a new model which meant that our members didn't need PRS that would be fine in principle. We should disappear because we would no longer add any value. But in practice we believe PRS can continue to add value and can have a fundamentally important role working with new technology in the digital age.* [52]

The value to incumbent organisations such as PRS or PPL of exploring a permissioned system is that it could remain internal to their structures; it would not have to be transparent (or at least it could be made selectively so) and could still provide them with some of the efficiencies of distributed systems.

From a purely pragmatic perspective, if you asked a technologist today what would be the most efficient system to build, using current technologies, to create a royalties tracking, gathering and distribution system, they would probably tell you it was blockchain. For that reason alone, in the interests of serving their members as effectively as possible, collecting societies in the music space ought to look into the incremental value of investing in new distributed ledger systems that might adopt a permissioned version of the blockchain protocols. Whether collecting societies could ever see it in themselves to step outside that and venture into a grander form of openness and public transparency is perhaps more doubtful. Interestingly, though, I suspect it would only take one to step boldly into this space to create an avalanche of followers.

Conclusions

Blockchain is a multifaceted technology viewed differently in different lights. For some, it is the ability to create a new truly distributed global repertoire database that holds the appeal. For others, the ability to pay all the contributors to a song quickly and fairly is more attractive. To others it represents a new opportunity for individual artists to offer their wares to consumers with very low cost of transaction and very high data gathering capabilities. For others it may provide useful proofs of concept to be applied elsewhere in completely different sectors of the economy. Given the hype it is healthy to be reminded of the wide-ranging caution of most executives in the industry.

It will always be the role of the hands-on entrepreneurs and artist managers to be pragmatic and cut through to the commercial realities of the moment. ATC MD, Brian Message characterizes the blockchain as having an "*immensely romantic attraction*".[53] Mark Meharry, CEO of MusicGlue, an artist's ecommerce platform, has called the blockchain the *"worst case of smoke and mirrors"* that he has seen in an industry which "*specialises in self-deception"*.[54] Nikke Osterback, CEO of Saari Ltd, a digital marketing company, shares this healthy dose of scepticism:

> *I don't see anyone in music expecting their fans to suddenly run down the road of digital currencies. That may happen in some other industries but it is a long way off happening in music. I think blockchain is basically a synonym for transparency… I think that when you see artists adopting the technology at this stage of its development, then that is about positioning them as an artist in relation to something new and hip,*

not because they are really embracing it. I think streaming is here to stay as the leading consumption method for music. It seems unlikely that anyone could usefully impose blockchain on top of a subscription service and do anything that it does not already do.[55]

Osterback highlights the degree to which blockchain is still wedded to its origins in crypto-currencies. It may be that if blockchain is further developed to adopt better to the specific areas of its application, that it will be more enthusiastically received.

It would be a mistake to rush to judgement or to draw firm conclusions about such a fast moving and rapidly changing scene. As we have seen there are multiple angles to this story of opportunity, evangelism and intrigue. For the music industry though, its mission should it choose to accept it, is to exploit all the emerging opportunities to its advantage, especially if new entrants come knocking and want to try stuff out.

There are three broad areas of potential benefit:

* A new music industry architecture for data and licensing
- A GRD with a focus on metadata and creator identity
- Incrementally gathered transaction-by-transaction
- Leading to a globally distributed licence exchange

* A viable business model for the long tail.
- Enable sufficiently low transaction cost levels that more bands might make a better living
- Enable entirely new independent platforms to emerge which might be able to work with a wide spectrum of lower level acts.

* New efficiencies for current leaders.
- Collection societies, major labels and publishers use private "permissioned" blockchains
- Render systems more effective through decentralisation
- Transition to consortia to scale, eventually possibly adopting some global standards

It seems unlikely that, in the short term, blockchain will do much to democratise the industry or level out the huge disparities between the large fortunes to be made by an increasingly small number of stars, with the many very modest existences to be eked out in the long tail.

As we have seen there are numerous players in the field, mostly focusing on opportunities for new artists to reach new audiences and create higher margins than current platforms provide. Whether such models like that proposed by Bittunes or PeerTracks can really be any more appealing or commercially significant than existing players such as BandCamp or MusicGlue, remains to be seen. Theirs is a numbers game in which they have to gain critical mass before they can offer any leverage to major name artists wanting to find large scale or differentiated audiences

Professor Schafer believes that the blockchain may not be so radical in its transformative powers initially, but *"in the end, if it is made easier for honest folk to stay honest, that is most likely to lead to commercial benefit."* [56] The creation of a new friction-free licensing and transaction layer to the industry might enable a larger number of artists to make a better living. Schafer seems to agree with the long tail optimism of Imogen Heap and Benji Rogers. He observes that currently even PayPal costs too much for the long tail of artists.

> *Blockchain/smart contracts could solve the problem – by making the cost of the transaction almost free and allowing much more automation.*[57]

Blockchain might just make it possible for emerging artists to no longer have to starve to death in the long tail, but even if the transaction cost were reduced to zero, I fear that the ratio of noise to talent and the real marketing, promotions expenses of rising above the noise will continue to outweigh any of the cost efficiencies blockchain alone might have to offer.

When it comes to the diverse new entrants all trying to jump on the bandwagon, I'm not sure that I entirely agree with Nikke Osterback, but he has a point when he says:

> *The worst nightmare that any of us could see happening is that there are suddenly loads of different artist block chains, one for each*

artist. That would be a consumer nightmare and pointless. Then someone might come along and try to add an aggregating layer on top of that – just rendering useless the directness and transparency that it achieves.[58]

A separate blockchain for each artist? I agree that would be a nightmare albeit an unlikely one, but it seems more likely that we will see multiple versions of the blockchain in different networks, with multiple artists signing up to them. This is already upon us and whether it yields any long term value is impossible to predict.

While the licensing benefits in a business-to-business environment might be apparent, the other area of some uncertainty for now is how any of the blockchain services might fit in with existing digital service providers. The idea that Spotify reengineers its entire platform in order to take advantage of blockchain efficiencies in advance of its much-vaunted IPO seems a little unlikely. Equally, a few quick interventions in the space and perhaps the adoption of some common data standards could position the company well in relation to where the technology goes next. While Apple Music has the deep pockets of its parent to draw on, re-engineering the iTunes store to take advantage of the blockchain also looks like a grand project too far, for now. Yet, it is the kind of strategic move, however far off the return on investment, which might just turn out to offer exactly the kind of analyst excitement that the long-standing NASDAQ stock requires to avoid stagnation. I suspect, however, that an Apple car may be more likely to achieve the required shift in market perspective at scale.

I do foresee something potentially quite intriguing in this context though in the formation of various permissioned consortia of corporate networks working together. Imagine the strength of a Google, Kobalt, Universal Music, and Sony Music blockchain or of an Access Industries blockchain made up of Warner Music, Deezer, Songkick and Perform (their advanced sports media company). Imagine perhaps a body like Merlin, along with Aim, deciding to take the plunge and form a public blockchain, transparent to all and inviting unaffiliated artists to attach themselves to it. The internet has taken over twenty years for the worldwide web and the mobile web to form themselves into a seamless and essential infrastructure for global economies. It does not seem unreasonable to think that it could take blockchain ten to fifteen years to do the same in the creation of its layer. Over such an extended time period, there is the potential

for some or all of these public and private systems to morph together into a new digital architecture for the economy as a whole and for the music industry in particular; cryptographically empowered, selectively transparent and eventually transformational. Anyone who thinks that all of this is achievable in the near future is clearly dreaming, but the potential first mover advantages and strategic motivations are intriguing. We tend to discuss technological progress as if everything happens in internet time, meaning in next to no time. The reality has been however, despite the urgency of economic booms that the infrastructural implementation of digital connected technology has occurred over decades, not months. The blockchain looks likely to be no exception.

Such intense and widespread enthusiasm accompanied by such unusually high levels of attention as blockchain has received, produces contradictory responses. On the one hand, there has clearly not been such a surge in collective interest in a potentially transformative technology, in the music industry and beyond, since the emergence of the internet itself. On the other hand, more analytical observers will wonder about the underlying strategic motivations of current high profile players – and the degree to which mere project or personal profile marketing is enough of a motivator. Looking at the appetite of the pure technology businesses that are placing bets in this sector, alongside their equivalent positions in other sectors, also raises some interesting questions.

In the context of the bigger investments being made in blockchain in other industry sectors and the jostling for position between innovative reformers and conservative incumbents, music may find itself positioned here, as we have seen before, as a useful, low risk, potentially high profile partner. If the question this raises is why would a large investor spend time and money in establishing blockchain for music, when they could make so much more impact and create so much more value in, for example, financial services and energy? Then the answer reflects music's unique position in culture and in the economy.

Music is unique among the creative industries. It has the power to act as a catalyst not just in its own transformation, but also potentially in the broader adoption of blockchain across the whole economy. Whether the subject is a challenger entity or an innovator in an incumbent business or a vendor seeking to sell to both, the needs are similar; increase commercial, public, and regulatory acceptance of their particular implementation of blockchain. The newer the technology and surrounding platforms, the greater the job to convince

investors and incumbent companies. Investment and large-scale adoption by big players at the very heart of our economy, depends on a number of factors being proven, such as market acceptance, consumer usability, utility, regulatory approval and commercial viability. The music industry and its creative artists in particular, represent a potentially attractive testing ground for these heavier duty applications.

If a company tries to create a blockchain for an electricity grid and it fails, the level of customer dissatisfaction is immediately likely to be high and potentially punitive. If the same company begins by creating a blockchain verification and validation system for a group of relatively unknown indie bands and it fails, less harm done. In addition if the innovator company does succeed in persuading some better known artists to participate, then the project could achieve scale rapidly and, just as importantly as we have seen, gain the publicity and media coverage which is so useful in providing the third-party endorsement for which investors are always looking. If the results are positive, the proof of concept and implementation-knowledge accumulated are there to use in other sectors while, maybe for music, the beginnings of a transformation of the whole creative economy might just get kick-started along the way.

If consumers, musicians and companies end up with a fair, transparent and more efficient digital eco-system, where everyone in the business of creativity, can be cryptographically secure and identities validated, then maybe for the very first time in the digital era, there might be a win-win to be achieved on all sides.

Somewhere, behind all of these quite pragmatic arguments sits a larger spectre of the fundamental need for renewal. As the rate of consolidation in the industry increases and the pain of falling revenues continues, it may just be that the industry and the broader creative community sees a way to act together to address the need for a new architecture. The truth is that the short-term power politics of this always seem to militate against the longer term strategic benefits. The level of commercial pain never seems to be sufficient in any one quarter to justify beginning an initiative that will inevitably cost money, but reduce the pain in the longer term. The possibility that an incremental series of steps could achieve something that a single big push could not is perhaps the real promise of the blockchain. If, in addition, the aspirations of open innovations such as the Berklee's Open Music Initiative are realised, it might just be that the traditionally

competing factions could find a unified core around which to compete for greater profits, more evenly distributed, in years to come.

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