

RUNNING HEAD: A DATABASE FOR THE DIGITAL AGE

A Database for the Digital Age:

A Look From Multiple Angles

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Abstract

In this paper, the author will look at the pros and cons of various types of databases available on the market as well as the database needs of the music industry. She will review previous attempts to update current processes and systems, and suggest what she believes to be the best solution for moving forward not only in the current digital landscape but also looking ahead to scale for what's to come.

Technology Review

Standard Database Providers and Types

First, the author assessed what's already available as far as database providers and types. Per Arsenault's article, she sums up the more popular options:

- Oracle is good for large organizations that handle enormous databases and need a variety of features.
- While MySQL can work with Oracle and DB2, you can spend a lot of effort to get it to do things other systems do automatically like incremental backups. There's no built-in support for XML or OLAP.
- Microsoft's SQL Server is a database management engine that works on both cloud-based and local services at the same time. A 2016 edition includes temporal data support, which makes it possible to track changes to data over time and reduce resource use. The latest version allows dynamic data masking, which ensures that only authorized individuals see sensitive data. It's fast and stable, and allows access to visualizations on mobile devices. Many individuals have issues using integration services to import files, which might make set up or digitization hard, but it seems tailored for those who use primarily Microsoft products.
- PostgreSQL can be used on even Linux-based platforms and supports JSON. It can be hosted virtually, physically or in cloud-based environments. The latest version offers larger

data volumes (handling terabytes of data) and an increase in the number of concurrent users, meaning its scalable. Security was improved due to support for both DMBS_SESSION and expanded password profiles. However speed may suffer during large bulk operations or read queries.

- MongoDB is versatile and connects databases to applications via a comprehensive selection of database drivers. It's designed well to handle variable data, but not relational data models. Documents can be validated during updates and inserts, and the text search functions have been improved. A new partial index capability allows improved performance by shrinking the size of indexes. It's fast and easy to use, data can be stored and accessed easily, and schema can be written without downtime. But SQL is not used as a query language, setup can be a lengthy process, and default settings are not secure.
- MariaDB makes a great use of resources via an optimizer that increases query performance and processing. It's highly compatible with MySQL, and it is a drop in replacement with exact matching of commands and APIs because many of the developers of MySQL were involved. It is fast and stable with extensive architecture and plug-ins allowing you to customize the tool to match your needs. Encryption is available at a network, server and application level. The engine is fairly new so there may not be further updates or versions.
- IBM's DB2 has NoSQL capabilities and can read JSON and XML files. The workstation version works on Windows, Linux, and Unix. LUW 11.1 was an improvement of Blu Acceleration, which was designed to make this database engine work faster through data skipping technology and make the most of available resources for enormous databases, as well as providing disaster recovery functions, capability, and analytics. It can be hosted from the cloud, physical server or both at the same time; multiple jobs can be run at once using the Task Scheduler; and error and exit codes can determine which jobs run. A con is

third-party tools or additional software are required to make clusters or multiple secondary nodes work.

- SAP SE's SAP HANA is column-oriented, and is designed to save and retrieve data from applications and other sources across multiple tiers of storage. It can be hosted on physical services or the cloud. It supports SQL, OLTP, and OLAP. The engine reduces resource requirements through compression and reduces access times with data stored in memory. Real-time reporting and inventory management are available. It can interface with a number of applications. It's still a newcomer, so patches and updates are too frequent.

Considering Industry Needs

As far as this paper goes, the author's primary focus is on digital rights management and the more immediate centralized database that would be developed by the Mechanical Licensing Collective (MLC) to manage and match streaming compositions to recordings. But the goal is to have this database be a larger, more universal one that's housing accurate and complete data for all music consumption and licensing on a global scale -- which goes beyond the scope of what will be covered in this paper, but is touched on briefly.

There are definitely technologies that are better suited than others for addressing the governance issues. Business Process Management (BPM) tools can handle a lot of this. There's also a great open source project called Egeria that has policy management for federated open data exchanges. There's a number of blockchain platforms that have great identity management tools and governance centered protocols as well. The solution may be found in a combination of technology available.

The industry has probably already accepted the cost and time investment in development will be high, so the author believes the main concerns are with security, reliability, and scalability. Being easy to use would help alleviate PROs from some of the fear of being replaced if they felt they could be trained to

utilize. Ultimately, it needs to be easy to use by end users, but a lot of that can be built into the user interface as the end users are not the ones presumably developing and updating the backend.

Initially, it would be easier to have a platform that allows plug and play between different systems and databases already being used to consolidate -- but then it makes the platform more susceptible to hacks and lacks a sense of security. It was the same concern that many have with blockchain -- that it's not so much that the data won't be secure once in the database so much as if it's secure going in from whatever API sources are connected to it and do we trust those appointed to "man" those endpoints.

In considering where NoSQL would be better than a relational database, they can be used in conjunction and it depends largely on prioritization as one offers more performance efficiency and scalability, but the other offers more reliability and is ACID compliant. The author tends to lean more NoSQL in the long-term as it tends to be better for big data processing beyond just transactional needs. But when we look at what we plan to do with the music industry data, it's about relational associations.

Having a solution or product that can be at least accessed via cloud services would be beneficial -- because if we're looking to add meta and other pertinent data at the beginning of music creation, there are several cloud song recording and mixing solutions that have sprouted up in more recent years. And it's more efficient to start at the beginning, doing things right, than having to work backwards.

Some experts in discussion with the author, who prefer to remain anonymous, suggest a mix of PostgreSQL and FoundationDB might solve the issue just fine for our immediate database needs, but the strength of the service comes from policies and decisions made rather than the storage engine itself.

Blockchain vs. Standard Database

Some more well-known players in blockchain development for music industry usage include RChain (and its associated RSong), Emanate, Mycelia, Verifi Media (formerly dotBlockchain), VEZT, Resonate, and Revelator. Ethereum is a platform that has been utilized a lot for new applications.

Blockchain providers tout a dynamic bundle that can be updated, but not wiped so that data can always be referenced if disputes arise. In a conventional database, one could still achieve immutability of records. Others have to trust that database managers, obviously, but that can be achieved through audit-ability of one's own solution. Easier said than done.

dotBC suggests a bundle .bc that saves the audio file, works data, recording data, PRO affiliations, territory and release information, and artwork. The idea behind blockchain is a more decentralized ledger where one can decide which permissions to give even though its public and accessible by all. There's an added layer of security that has been touted about using blockchain over other tech while providing the benefits of accessibility and efficiency where needed (Johnson, 2018).

However, the concern is that bad data in equals bad data out -- that we must first set a standard and clean on *any* database before considering blockchain as it would presumably cost more time and money to implement than a standard database would accordingly to many music tech experts the author spoke with who prefer to remain anonymous. It may be hard to move over later -- but until blockchain development is further along and there can be a standard set for any "tokens" being used, it would only add to the fragmentation without much additional value when compared to other database solutions.

The author is working on a larger thesis paper that covers this topic in depth. To highlight some policy concerns that would need to be addressed before considering blockchain as a good market fit:

- There can be a problem when certain financial institutions are required by law to permanently remove data when required by a court via "right to be forgotten" laws, and the tech doesn't support deletion.
- Institutions currently involved in the verification process for IP would need to reform accordingly such as if blockchain digital signatures became more widely admissible in court.
- More widespread updates to laundering statutes would be needed, especially in creating a definition for cryptocurrency as a monetary instrument.

- Jurisdiction priority would need to be set in stone when it comes to authority over contract and what tokens or currencies are permitted via the platform on a global scale.
- The lack of direct communication between the parties could be a problem as financial services usually need to comply with rules pertaining to knowing one's customer.

That being said, the author believes that the industry will probably follow a two-phase process: 1) involving data clean up, standardization and digitization on more developed databases and 2) involving more universalization and blockchain technology consideration.

Current Industry Databases

Evers' article further highlights how behind the industry is with the current state of database standards being that we accept the no bid contract to use SoundExchange and it's a horribly flawed database (MDX) as the foundation for the MLC. At the end of 2017, SoundExchange had \$294 million in unpaid royalties due to bad data or missing documents -- so this doesn't sound like a database one wants to inherit.

Next, the author takes a look at some of the previous attempts to develop a clean, universal database, so we know what to consider to avoid similar failures in upcoming attempts.

Preview Attempts To Update Databases

While the author is sure several less publicized attempts have probably been made, a few notable ones are below.

International Music Joint Venture

The International Music Joint Venture (IMJV) formed in 2000 by a group of collection societies (ASCAP, PRS for music in the UK, and Canadian SOCAN), pushed by Dutch PRO BUMA/STEMRA. IMJV invited CMOs like SGAE from Spain, BMI and Harry Fox Agency from the U.S., but they did not join. The database was supposed to be created using metadata stored on Utrecht and London computers (Dewritech, 2019).

Problems arose because IMJV had ulterior motives for STEMRA to move around employees they could not fire because of the laws in Holland at the time. This is why GEMA in Germany refused to join. This could have been one of the first major scares for CMOs potentially becoming redundant and they became reluctant to share repertoire. In late 2011, the initiative dissolved without a single operating office -- but at its peak, it represented 21% of the world's music (Dewritech, 2019).

Global Repertoire Database

The Global Repertoire Database (GRD) was brought into life by EU Commissioner Neelie Kroes in September 2008 with the hopes of being openly available to songwriters, publishers, and Collective Rights Management organizations. It would allow organizations to maintain their current systems by accessing through their own portals and would minimize inconsistencies from registrations only having to be entered once (Milosic, 2015).

It had potential with cross-sector entities in roundtable discussions about efficient licensing and distribution of music online. It included big players like Universal and EMI Music Publishing; tech companies like Apple, Nokia, and Amazon; collection societies like PRS, STIM out of Sweden, and SACEM out of France; and several organizations like the International Confederation of Societies of Composers and Authors (CISAC), the European Composer and Songwriter Alliance (ECSA), the International Confederation of Music Publishers (ICMP); and other big players like Omnifone and Google. The Working Group recommended the International Copyright Enterprise (ICE) as a solution provider and business-consulting firm Deloitte to manage the effort to build the GRD. It eventually had over 80 organizations and more than 450 individuals across 6 continents (Milosic, 2015).

When looking at where GRD went wrong, according to the Edwards article, there were critical questions that needed to be answered and addressed prior to charging ahead:

- Who will be the GRD's co-founders?
- Who will provide the seed capital?

- How will it develop its offering?
- How will it scale?
- What will the roadmap look like for participants and for funding rounds?
- What are the rules, governance and oversight?

Also, it's important to note that ISRC code and recordings were out of scope for the project; it was focused on underlying composition -- so an attempt to marry ISRC and ISWC was not made.

Presumably, the ideas was most the data inaccuracies or incompleteness lie with the composition side and this would need to be fixed before even considering anything else. The intention may have been good, but part of the reason the GRD failed was due to lack of planning on behalf of the parties involved and perhaps too limited a focus.

Having different data standards is another reason why the GRD WG struggled (Milosic, 2015). The author will cover more on data standards later.

The GRD failure was announced in July 2014, leaving beyond \$13.7 million in debt. One of the biggest issues was funding to set up (23-23 million Euro divided amongst societies according to their size) and operate (6.4-11.6 million yearly) was expensive while savings were estimated at as low as 0.7% of annual global royalty revenue (Milosic, 2015).

As a comparison of an execution probably done more successfully, the World Wide Web Consortium (W3C) and the Internet Corporation for Assigned Names and Numbers (ICANN) moved quickly to establish an ecosystem. W3C was founded by Tim Berners-Lee in 1994, only five years after he first invested the World Wide Web. ICANN was conceived in 1998, and incorporated in the same year. They weren't global, but intended to be independent with some level of governance and oversight. Governments (the European Commission and U.S. Department of Commerce) and academic institutions like MIT and Information Sciences Institute at USC had a role in their inception. They faced criticism and scaled over time, but they knew that acting early on would save them the headache later (Edwards, 2016).

WIPO's IMR

The World Intellectual Property Organization (WIPO) created their International Music Registry (IMR) which was launched in 2011. WIPO involved both sound recordings and compositions. They ran a successful global patent database and registration system, and another focused on trademarks. Google agreed to fund WIPO early on, but WIPO broke off the partnership thinking it would give Google too much power. WIPO tried to fund the project themselves. In-fighting among the different record label and publishing powerhouses, it collapsed (Dewritech, 2019). Although there's still some debate that it's live and kicking in some form or another.

Joint Database Battle

As mentioned in the Lossa, Nevins and Fischer press release, in 2017, ASCAP and BMI were testing the combined data sets in a cloud platform, and the results of that analysis would serve as the foundation for the joint database. Phase One was expected to launch by the end of 2018, and include the majority of ASCAP and BMI registered songs. It would be secure, user-friendly and searchable and would be updated as new information becomes available. Future phases would explore customizable, interactive API solutions and the potential inclusion of other databases.

Per the same press release, it was written that ASCAP and BMI have proven their commitment to industry-wide data transparency by making public aggregated song share ownership through their respective online, searchable repertory databases – ASCAP's ACE Repertory and BMI's Repertoire Search. Both PRO public databases already include the following information, which will be combined in the joint database:

- Song and composition titles
- Performing artist information
- Aggregated shares by society for ASCAP & BMI
- International Standard Work Codes (ISWC) and other unique identifiers

- IPI names and numbers

One issue was not having SESAC and GMR as part of the plan from the get-go. The MIC Coalition, a lobbying group representing the tech and radio sectors, lambasted the PROs. In the same year, the RIAA & NMPA went up against the PROs to propose their effort to create a joint database -- and similarly, they were hit with criticism, because many wanted the Transparency in Music Licensing and Ownership Act to be regarded and Congress to be the one to create the database as a more “impartial” party (Sanchez, 2017). If any less was learned, it’s that several parties in the music industry have to work together for something that is meant to be “universal” or “large-scaled” -- because it’s truly too large and impacts way too many individuals to deserve any less.

Approach Moving Forward

The author’s suggested approach going forward entails aspects of standardization, digitization and universalization -- each with their own unique challenges to address.

Standardization

Standardization is a broad term that encompasses consistency, clarity, and quality. It can be in regard to a process followed or a specific criteria that needs to get met.

As an artist, quality is something we all should naturally strive for when it comes to audio and visuals -- but adapting for every platform or database gets tedious. There are some general rules of thumb.

For album artwork, a standard 12” sleeve specification for a physically printed product is 300 dots per inch, which translates into a digital file of 3600 pixels x 3600 pixels. Sourcing a file of 4096 pixels x 4096 pixels, as 4K TV displays are 4096 pixels wide is recommended to make it future-proof for when music consumption moves to apps on the big screen in the home and services become more ambitious with visual design around cover art (AFEM, 2019).

For the audio itself, mp3s are dying out in developed markets as smartphones pack in more memory and the services and networks become able and willing to handle more data. Consider a high

quality file as the master file - 24bit, 96kHz is the highest you need to go, and of course all lower quality files required can be encoded from that high quality master file. Again, this approach will future-proof your content and enable you to serve those listeners who are keen to listen in high quality. This also benefits DJs buying electronic music downloads who know that lower quality files are not as good to play out through high-end audio systems in clubs (AFEM, 2019).

In 2001, the International Organization for Standardization (ISO) announced the ratification of the International Standard Musical Works Code (ISWC) and it's not recognized as the unique standard for worldwide identification of musical works, referred to as ISO/15707 (BMI, 2001). That's pretty new considering how far back music catalogs go. One of the big issues the industry is facing has to do with matching ISRC (the standard for a recording) with ISWC (the standard for the composition). With multiple publishers, songwriters and trading of hands, it has been hard to track where errors were made and who should be held accountable.

Relying on simply disseminating education about what metadata or minimum viable data standards required (i.e. song name, artist, composer and respective percentages with CAE/IPI number, genre, BPM, barcode for album or single, ISRC and ISWC codes, ISNI number to differentiate one from other artists or bands with the same name, and Tunecode allocated by your PRO) and hoping individuals follow protocol hasn't been working well. That could be in part to the required formats and fields themselves required varying from database to database, or distribution channel to distribution channel.

Some even require additional metadata that make the process of ensuring one includes everything imaginable that might be needed more cumbersome. For example, digital service providers ("DSPs") typically assign their own unique identifiers to recordings (e.g., Apple's "ADAM ID") and publishers often include their own unique song codes (e.g., UMPG's "PIP code"). Music Reports, Inc. currently manages the most comprehensive proprietary identifier in the ecosystem—the "Songdex ID," which identifies more than 30 million songs and pivots through their ties to a set of more than 150 million

distinct recordings (Colitre, 2019). It would seem inaccuracies have led to each party feeling safer having their own identifiers, which leads to inconsistencies across that ultimately causes more inaccuracies.

Then, ensuring people register with PROs, SoundExchange, Harry Fox (or now the MLC) as well as that they report proper splits at every phase of pass-off as they change is extremely hard to manage manually across every individual involved within a project. It's not necessarily that we don't have a standard protocol for various scenarios so much in that we just have so many scenarios that it's hard for one to keep track of all the different protocols attached. What if all guides were "programmable"?

A question becomes whether there is one person at the helm to collect *all* the data like a project leader -- or is it the job of each individual to enter in data respective to their role with the project as it trickles down the value chain? In order to incentivize accuracy of data, the best thing to do may be to put the onus on the artist, label, publisher, etc. that if one doesn't provide the information, he or she doesn't get paid. The initial thought would be that an individual would at least care about entering pertinent data to he or she getting paid and that most of it could probably be added in the beginning by the songwriter. But the problem lies in changes not always being made in a linear fashion. The author will cover the "who's in charge" aspect of the problem later in this paper.

Digitization

One issue is that many don't want to share their data openly and it's almost required to find missing pieces in a puzzle when they're spread out so wide. And while the initial instinct is to crawl back to the familiar standard databases, many will stand by blockchain's smart contracts and strong permission based protocol. But the smart contracts would take ages to program for the number of potential scenarios that could exist -- so if blockchain was to work in this regard, it would have to enable end-users to be able to quickly and easily "program" themselves. Also, context would still be reviewed manually. Legal contracts would still exist while simple splits and non-context based automations could be added as smart

contracts for the sake of efficiency and accuracy in those areas. The key is that it wouldn't be a full digitization solution; it would meet specific needs.

One approach to not just digitization, but what we digitize and how we match while we digitize is to categorize what we do have based on entity that distributed and stream count, if this information can be found. We might find a pattern of bad or missing data coming from a clear source. If we identify where the unmatched come from, this helps us prioritize the effort.

The digitization of recordings is easier to start with -- but also the further along we go digitizing one side of the copyright without the other, it would seem we're adding more to the mess. The digitization will take time for the industry to do with their vast catalogs they're having to dive through. But by having a database where end users can help in the effort of pairing what's already digitized -- because a songwriter or artist knows their works best -- it could speed up the process of lessening the gap. The MLC will be putting more burden on the artist -- but as long as there's a common location and protocol, the shift should have a more positive impact than negative if more people start jumping on to organize.

Universalization

As the Milosic article suggests, the Copyright Office and PROs have national databases, but many agree a multi-national database would save on transaction costs as current databases still seem outdated or not comprehensive enough. It would be rather hard to combat piracy if not all works are registered or easy to search. With the song recordings, it tends to be a little easier than the compositions as there presumably are less individuals involved in the creative process.

But choosing a database is only a small part of the problem when one looks at all that we're trying to accomplish in a global digital landscape. As Cooke's article mentions, the hurdles that we still fight to get past are the following:

- Those who make lots of money from unclaimed royalties don't always see the long-term benefit of transparency and efficiency outweighing their current paychecks.

- Although administrative costs can be lowered, many (e.g. PROs) fear job displacement rather than focusing on the enablement of innovation and efficiency leading to new jobs. We could force the publishers and societies to make their databases public domain, and then let third parties develop the uber-database for song rights, and let the market decide which one best does the job -- or perhaps not involve PROs at all.
- There are quite a few technological, legal and policy barriers that need to be addressed first. Europe struggled to set appropriate databases and legal solutions, and its revenue collecting system was more complex than the U.S. Part of the issue is that U.S. collection societies only manage public performance rights while European manage both public performance and mechanical rights.
- There needs to be a statutory obligation to register copyright works in most territories, which doesn't currently exist.

Who's in Charge

The author feels nowhere near qualified to offer the best solution in this case -- but going back to governance, we have to answer these questions to know how to best execute:

- Who has the right to submit data? Who has the obligation to do so?
- Who has the right to correct what they think is erroneous data? Who can change it back?
- Who authenticates that the party presenting data is who they say they are?
- How much reliance is placed on data stored elsewhere under different governance (IPI, ISWCnet, etc)?
- Who has the right to assert links between data items (X is a recording of Y, Z is the songwriter of Y, V performed on X, X samples W)? To un-assert them?
- Who is going to pay for the operation of the database? For access to the data? For the submission of data?

- What is the policy on access rights? Ownership of the data (whatever that means)?

We run into a case of the chicken or the egg -- does the technology help us determine how we will govern or is the governance what helps us decide on the technology?

What makes it hard to determine who should be given authority is the fact that there's lots of overlap in roles and player interests. Someone is not merely part of just a tech company or just a publisher represented organization. While assessing the conflict of interest, people may naturally gravitate toward having equitable disbursement, which has actually led to fragmentation. Instead of coming together to plan, interest or party focused groups spin off to try to come up with their own solutions to better serve that focus area. Everyone wants to be the superstar.

It would seem natural to have the Copyright Office (and associated counterparts globally) manage a universal database. Then, from there, individual views can be provided for organizations, committees, and the general public based on what they manage or query.

Although some fear this is giving way too much control to the government, such as remedies available to copyright owners to bring infringement actions for copyright violations being limited if they don't support the database with their information (Bludov, 2017). One expert the author spoke with believes an approach would be to reduce the value of infringement to the copyright owner. Sure, we collectively might howl for a bit, but there would be less incentive to lobby, and more incentive to license as a result. Is it a short-term hit for long-term gains?

But what's going to be a very hard part to universalizing is how various territories view government involvement and how much it shares with its public. Think of how China's government varies from Africa's varies from the U.S. -- no easy feat.

If decentralization -- keep in mind this is different than fragmentation -- is considered with blockchain, why not with the way we structure the various parties involved in copyrights, licensing and royalty disbursement? In order to utilize local knowledge and tailor flow for efficiency in different

territories, a centralized umbrella should set the standards and make sure they're followed as well as provide access to the universal database hub. Right now, there's too many parties fighting to be boss or seen on an equal playing field, so it's a tug a war. Ultimately, one global committee should be managing the subsidiaries. And then if some consolidation takes place such as the MLC potentially being more involved in interactive, non-interactive, and satellite, it will still have oversight and not be under antitrust concerns as a consolidated subcommittee.

Conclusion

So, what can really be gleaned from all this is that it's just as much about the process and the people managing as it is about the technology on the backend of any database. To concretely say that there's one absolute solution would be naive to the fact that there are multiple factors to consider in whether an implementation and adoption pan out the way the industry hopes it will.

Still, if we start asking the right questions and looking at where we went wrong in the past, we can gradually work toward a more fine-tuned solution for digital rights, licensing and royalty management on a global scale. But in the end, we've got to work together to make it happen.

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