Descriptive Metadata In The Music Industry: Why It Is Broken And How To Fix It

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Abstract

This report examines an ongoing problem with descriptive metadata in the music industry. Stakeholders agree that there is a problem with descriptive metadata (popularly known as credits or liner notes). But consensus has not been reached regarding how to fix it. The report first covers the issue’s background, showing evidence that descriptive metadata in digital downloads today is no more detailed than on audio cylinders of 1899. Then it examines two keystones to a solution: a standardized descriptive metadata schema, and a Globally Unique Abstracted Persistent Identifier (GUAPI). While previous discussions of this topic have concentrated on authority, this report will show that a standardized schema is the first step to a solution.

First, the landscape of music descriptive metadata silos is detailed and the proprietary and open systems are compared. Next, persistent identifiers are examined to gauge their suitability as a GUAPI. A study is proposed to quantify richer metadata’s ability to increase music sales. Potential arguments against richer metadata are also examined.

Finally, a proposal is made that brings together the component issues. A standardized schema is proposed by combining two current schemata, CCD (Content Creator Data) and MusicBrainz. A method of achieving a GUAPI is suggested by increasing the coordination of current identifiers. By creating a fully abstracted model built upon these components, digital downloads would be more easily enriched with metadata. Benefits would flow to all parts of the ecosystem, including business, technical, creative, and consumer. Business would be enhanced through a more powerful platform for innovation and a richer consumer experience. Technical advances would be fostered. The creative community would be properly acknowledged, and consumers would gain a deeper knowledge of the art they are supporting.

Introduction

The music industry has a metadata problem. Descriptive metadata associated with an audio recording could detail a wide range of information about the recording, from the most basic elements (artist, title, composer, or date) to richer elements (record label, producer, engineer, backing musicians, instruments, location, etc.). But this essential information is missing from music as it is distributed today.

Throughout the history of music, there has been a need to describe creative works. The history of music metadata could be said to have its origins in printed musical scores, which predate recorded audio by hundreds of years. After audio recording and playback were achieved, the formats have had varying abilities to hold metadata.

The inclusion of descriptive metadata with recorded music has been motivated by multiple goals. From a business standpoint, promoting the names of artists and record labels was intended to increase future sales. This branding created an audience willing to purchase music. From an organizational standpoint, the metadata allowed more effective delivery to retailers and better collection management in stores and homes. From a legal standpoint, record labels were contractually obligated to pay royalties to certain artists, songwriters and producers.[1,2] Acknowledging the contributors to a project also rewarded their work and was the right thing to do.

But despite these reasons, the richness of the metadata attached to playback formats has followed a bell-curve. The earliest cylinders in the late 1800s contained minimal information, such as a spoken introduction, a small sticker, or a slip of paper.[3] The era of the Long Play (LP) record brought large gatefold liner notes filled with descriptive metadata, artwork and lyrics. The Compact Disc (CD) bridged the eras of the LP and the digital download, trying to emulate the LP's wealth of metadata. The era of digital delivery through online download services brought plurality and convenience. In 2013, cutting edge technology delivers music in a convenient, small file format that consumers download (or stream) easily and inexpensively. But amazingly, that delivery method contains about the same amount of descriptive information as Edison cylinders from the 1880s.

In today's information-based economy, it is more important than ever to build robust data infrastructure. Some have predicted that our economy is moving from an object-based model to an attention-based model, making intellectual property and cultural capital more valuable.[4] When digital music is viewed through a wider lens of economic theory, the value that metadata adds to intellectual property is even more significant. Without descriptive and ownership metadata, music files are indistinguishable from similar items. As the Napster era of file sharing demonstrated (and as an extensive dissertation explains), this lack of differentiation makes music files commoditized and worthless.[5] Piracy is more likely when the plunder is viewed as homogeneous. Now is the pivotal moment to correct problems in the infrastructure that would otherwise stifle growth and hinder the flow of data for decades.

This report will examine: the reasons behind the lack of descriptive metadata in digitally distributed music, the arguments for and against it, the stakeholders, the case for its value, a proposed study, and proposals to fix the problem. The issue is partly technical, largely based on business criteria, and increasingly pertinent.

Descriptive Metadata: Now And Then

In March 2013, legendary music producer Phil Ramone passed away. After 54 years of work as an engineer and producer, he had earned 33 Grammy nominations, 14 Grammy Awards, a Technical Grammy, and an Emmy.[6] By one source, shown in Figure 1, he has 967 credits from 1959 to 2013.[7]

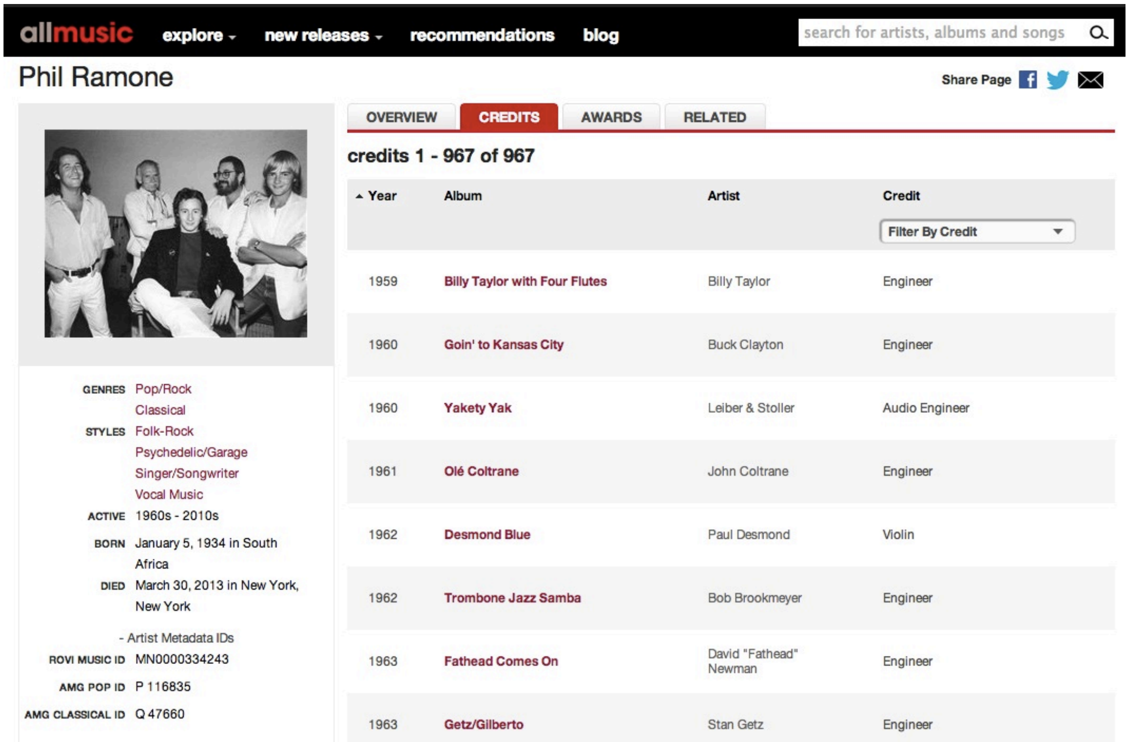

Figure 1: Credits tab of Phil Ramone's entry on allmusic.com, showing 967 credits.

A 2013 search for Phil Ramone in the iTunes store music section is shown in Figure 2.

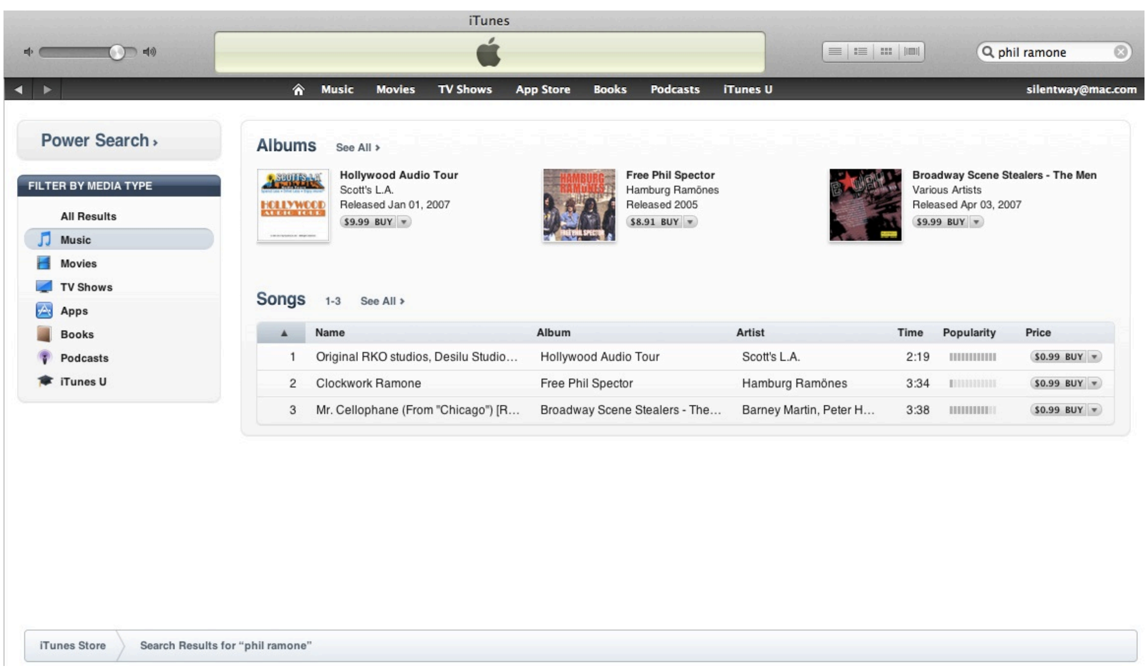

Figure 2: Search results for Phil Ramone on iTunes, showing two incorrect items and one correct result.

The three tracks found on iTunes include an audio driving tour of Hollywood (mentioning Dr. Phil and the grave of Johnny Ramone) and “Clockwork Ramone” from a German punk album “Free Phil Spector.” Confusing Phil Ramone with Phil Spector is unfortunate for many reasons, but at least they were both music producers. Confusing Phil Ramone with Johnny Ramone’s grave is a pure failure. The one track shown that Phil Ramone was actually involved with was from the soundtrack to Chicago, which Mr. Ramone produced. Compare that to the 967 songs listed in the unofficial listing at allmusic.com. This disparity occurs because the iTunes catalog contains minimal descriptive metadata.

The iTunes store and its current competitors such as Amazon.com are similar in this regard. Take for example the song “Loves Me Like A Rock” by Paul Simon from the 1973 album “There Goes Rhymin' Simon.” This purchased file will contain the name of the track, artist, album, the year, the album cover, and possibly the composer/songwriter. But a track purchased from an online store won’t contain metadata such as the co-producers (Phil Ramone, Paul Simon and The Muscle Shoals Sound Rhythm Section) or the musicians (including the Muscle Shoals Sound Rhythm Section and vocalists The Dixie Hummingbirds). See Figure 3 to compare this song downloaded from iTunes, the same song from Amazon, and a cylinder recording from 1899.

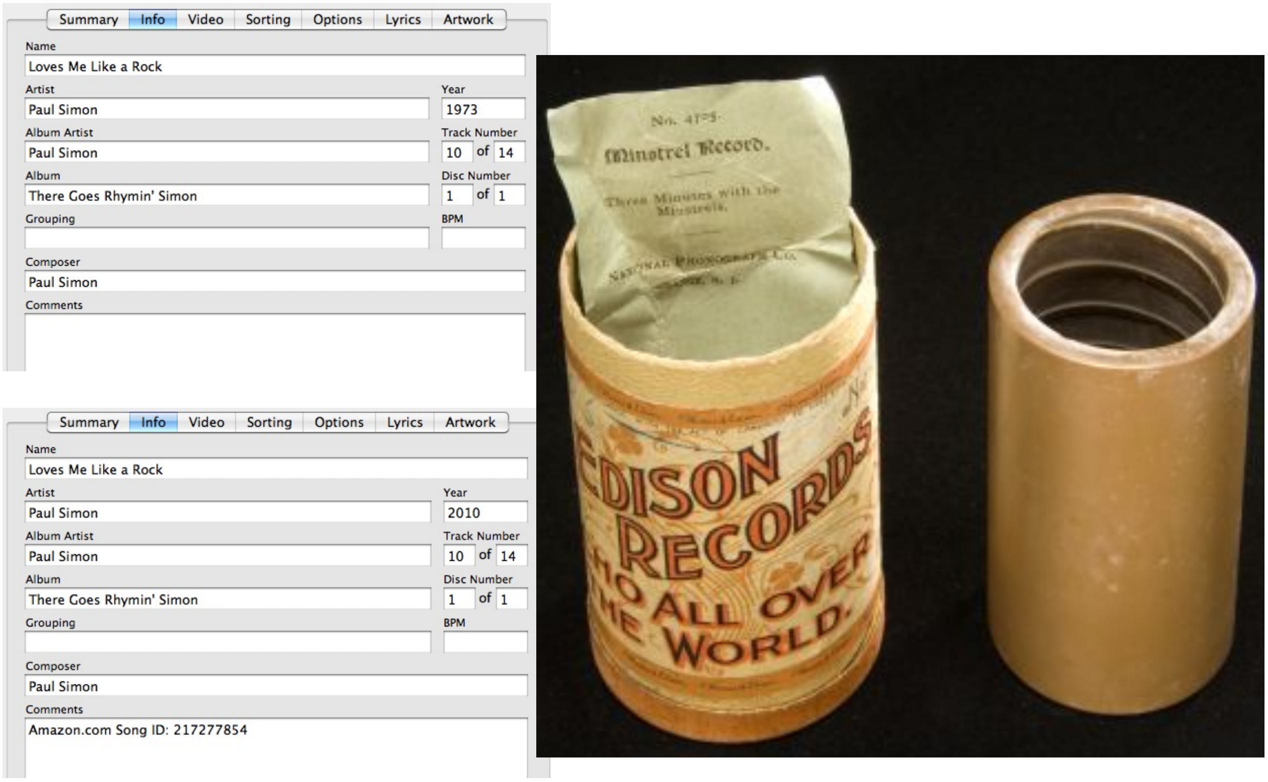

Figure 3. Examples of descriptive metadata. Above left: "Loves Me Like A Rock" from the iTunes Store. Bottom left: the same track from the Amazon MP3 store. Right: 1899 Brown wax cylinder with container and paper insert.[3]

As the figure shows, the 1899 cylinder included a paper insert with basic information such as the title, record label and catalog number. Certainly there have been many improvements in 114 years, but the richness of descriptive metadata has barely changed. What will we think of a 2013 digital download in the year 2127?

Terminology

As this topic is loaded with terminology, a few definitions are in order. See the appendix for a reference to many acronyms.

"Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource".[8] Metadata is commonly referred to as "data about data." In the realm of music, metadata can be found in many forms. "Descriptive metadata" (the subject of this report) is a type of metadata concerned with describing the content of a recording such as the song title, performing artist, and year of release. This is distinct from "technical metadata" which includes information about the delivery media such as file type (e.g. mp3, m4a, wav), bit rate, and sample rate. "Administrative metadata" is used for managing a collection of files (e.g. date modified, sort fields). Another related type, "structural metadata" regards compounding multiple items into one object.[8] Technical, administrative, and structural metadata are not covered in this report.

A type of metadata that is distinct but closely related to descriptive music metadata is performing rights metadata. This details ownership agreements for the purposes of calculating payments for sales, airplay, and moving picture synchronization. This type of metadata is extremely complicated due to the multiplicity of "splits" (fractionalized shares for composers and stakeholders) and differing laws in international territories. It is very difficult to ensure that payments from consumers are divided up appropriately and actually reach the correct people. When a song is purchased on a CD, played on the radio, streamed via an online subscription service, downloaded as a file, or performed live, various people are owed money, and each situation has a different payment breakdown. For example, multiple songwriters will split a song's royalties according to agreed-upon percentages, and a producer may be owed a percentage. Depending on the situation and song, the entities involved may include: songwriters, performers, musicians, producers, publishers, physical retailers, distributors, record labels, and performance rights agencies. Each of these in turn may have their take fractionalized by separate deals. On top of that, it becomes exponentially more complex because many countries have different rules about all of this.[1,2,9] These arrangements also change often as catalogs change hands.

This web of performing rights metadata is extremely complicated. It is also very important to the industry, as it is a significant portion of revenue. So, the stakes are much higher than with descriptive music metadata. Descriptive metadata, which is seen more by the public, also has different accuracy criteria than performing rights metadata. By separating the two types of metadata, each can have appropriate requirements, governance, and audiences.

Because of these many factors, performing rights metadata needs to be handled in a separate metadata standard distinct from descriptive metadata. (Although the two would certainly interact.) That performing rights metadata standard, as a revenue-critical system, would logically be funded by stakeholders whose interests would be most affected. Those who stand to gain from an efficient system to track and enable payments have the most ability and responsibility to fund such a standard. Performing rights metadata will only be mentioned briefly in this report.

This report will only address descriptive music metadata. In the remainder of this report, "metadata" specifically refers to "descriptive metadata in music delivery formats."

It is worth noting the conceptual difference between subjective and objective metadata. Objective metadata is factual, such as the title of a track, the name of an artist, and the producer. For objective metadata, there is a true answer. There may be disagreement or errors, but a value is intended to be fact. On the other hand, there are metadata values that are subjective. Genre, user ratings and folksonomic tags are examples of metadata that are based upon human evaluation and are thus subjective. Subjective and objective metadata are often presented together, but require different management approaches.

An "authority" is a definitive source of information that holds many "authority records." An authority record dictates the precise spelling of a term, and collects variations under a single preferred term. To be adopted by a wide range of users, an authority needs to be independent, centralized and comprehensive. An example is the Library of Congress Name Authority, which maintains a comprehensive database of authority records which is updated daily and is free to the public.[10] A “controlled vocabulary” is an authorized list of approved terms used locally by a particular metadata system. A controlled vocabulary may be derived from a recognized authority, or it could be locally generated. For example, a music catalog needs to decide upon a single way to display the name of the artist from Minneapolis whose hits include “Little Red Corvette” and “1999.” The Library of Congress Name Authority has chosen the name form “Prince.”[11] So, the manager of the music catalog may follow the Library of Congress (LOC), and choose the name form “Prince” to be listed in the local catalog’s controlled vocabulary. The manager will also set all other search term variations to point to it, including “The Artist Formerly Known as Prince” and “TAFKAP”. At a later time, another worker entering a new record in this catalog will only be able to choose “Prince” from the controlled vocabulary (by means of a pop-up menu or autocompleting field rather than by free-text entry). A user will find this record whether they search the catalog for “Prince” or “TAFKAP.” This minimizes confusion and matches all potential user searches. A controlled vocabulary is an example of a “data value standard.”

Another term is a “data content standard,” which dictates the manner in which information should be entered, such as abbreviations and capitalization. A style guide is an example of a data content standard. For example, the recent “Music Metadata Style Guide” dictates rules such as how to indicate a primary artist in a duet, and when to use "feat." and "with".[12]

An essential term to understand is “schema” (Plural: schemata or schemas). A schema is a prescribed set of metadata elements designed for a particular purpose. Note that “schema” does not refer to the actual metadata but the way the metadata is organized. A schema labels the locations where pieces of information go. For example, an audio file standard may have a schema that dictates that there shall be fields called “artist,” “title,” and “year.” Another example is a wall of post office boxes, whose numbers indicate where letters should be delivered. The schema generally dictates what each field is used for, and sometimes mandates how the data should be entered. The actual metadata can then be entered into these fields following this plan.[8] Standardized schemata allow for smooth transmission of metadata between systems.

It is worth reiterating the distinction between a method of exchanging metadata and a collection of descriptive metadata. (These are commonly conflated.) Schemata are essentially languages for how to communicate metadata. These are distinct from particular collections of metadata, such as those owned by companies or those built by collaborative efforts. A number of these collections will be described shortly, and will be referred to as "metadata silos." Each metadata silo uses its own internal organizational schema. There is currently no standard schema for the interchange of descriptive metadata about music.

A "persistent identifier" (PID) is an alphanumeric string that represents an item such as an audio recording, book or web address. When a persistent identifier is also standardized and globally unique, then it cannot be confused with another identifier. Thus, a globally unique persistent identifier should be a guaranteed "pointer" that does not conflict with any other identifiers. Examples of these are Universal Product Code (UPC) for products, International Standard Book Number (ISBN) for books, ISTC (International Standard Text Code) for textual works, International Standard Recording Code (ISRC) for recordings, Global Release Identifier (GRid) for recordings, and ISWC (International Standard Musical Work Code) for musical works. PIDs are essential for distinguishing between unique items. PIDs are also the key to any descriptive metadata system because accurate identification of entities is mandatory for precise description. Note that PIDs do not carry descriptive information beyond very brief text, which is just used for verification and disambiguation.

One of the most important terms used in this report is that of an "abstracted" model, consisting of multiple description layers in a hierarchical structure. A well-known example of an abstracted model is the location terminology of country, state, city, postal code, street name, and building number. (ZIP is the postal code used in the United States with similar models in most other countries.) This abstracted system describes decreasing orders of area. By representing each level of the hierarchy with increasingly precise detail, this system can aggregate or distinguish entities at any level. For example, the system can group (aggregate) all buildings within one postal code, or all postal codes within a state. It can also single out (distinguish) one building, or one state. These powerful functions are possible because the system is abstracted.

One use for this standardized system of location metadata is delivery of mail. The global physical commerce system depends entirely on this system to transport goods to their destination. But the system also enables many more organizations and services to operate: governmental departments (the Post Office, fire department, police department, elections), private companies (Federal Express, United Parcel Service, taxi services), private contractor services, and individual meetings. This comprehensive, standardized, abstracted model enables all of these to function. The postal code is just one piece of the system, representing one level of the hierarchy. Without the additional and hierarchical nomenclature we use for countries, states, streets, and addresses, the postal code is just a flat delineation of a particular land area. When the postal code is part of a fully abstracted system of descriptive metadata, each part of the system becomes more valuable.

Another example of an abstracted model is the telephone numbering plan, which is created by combining a country code, an area code, an exchange code, and a few more digits (four in North America). This appears as a single string of numbers but actually is a multiple-level hierarchical system representing increasingly smaller groups.

Music can also be described with an abstracted model, enabling detailed description of relationships. Abstraction can be used to distinguish between a musical composition and a particular recording of that composition. Or, to distinguish between an album and the tracks it contains. For example, does the title “Loves Me Like A Rock” mean a particular digital file on a consumer’s hard drive, or the song when referred to generally, such as in a music review of an album? Or, does it refer to the meaning of the song as first imagined by Paul Simon? Does it refer to the studio version on his 1973 album or a cover version by the Dixie Hummingbirds from 1990? Similar questions arise for movies, books, and other creative content. In addition, music is now released in many more formats than there were in the era of the LP and CD, and tracks are often not packaged as an album. Which version of a recording is this one? All of these questions can be answered by using the richer language of an abstracted model. It then becomes easier to describe complicated relationships.

There are a number of conceptual models in use today that distinguish between multiple levels of abstraction to allow more precise description and organization of creative works. These include the DDEX (Digital Data Exchange) suite of standards, MusicBrainz, FRBR (Functional Requirements for Bibliographic Records), and <indecs> (interoperability of data in e-commerce systems). See Table 1 for a comparison of abstraction models for a particular song. This table will be referred to throughout this report, and the importance of abstraction is central to the report’s main arguments.

Table 1

Abstraction Levels as Represented in Various Descriptive Metadata Models and Persistent IDs

Example	DDEX Term	FRBR Term	<indecs> Term	MusicBrainz Object	GRid Term	Pertinent PIDs
The creative thought process that is represented in the song "Loves Me Like A Rock"	Musical Work	Work	Abstraction	Work		ISWC, MBID
Final master recording of "Loves Me Like A Rock," independent of the format in which it is released	SoundRecording	Expression	Reproducible Expression	Recording	Digital Resource	ISRC, MBID
"Loves Me Like A Rock" as it appears on the album "There Goes Rhymin' Simon"	TechnicalSound RecordingDetails	Manifestation	Manifestation	Track	Resource	ISRC, GRid, MBID Physical only: UPC/EAN (ICPN)
A consumer's individually purchased file/stream/CD of that version of "Loves Me Like A Rock"	Product	Item	Item		Product	

Note. Data adapted from CISAC;[13] DDEX;[14] IFPI;[15] Library of Congress;[16] MusicBrainz;[17,18] and Rust and Bide[19]

Abstraction is clearly important, as evidenced by the existence of these complex metadata models, born of many years of work by various organizations. And abstraction shows its universality in the fundamental similarities between these models. Each descriptive metadata model describes multiple levels of abstraction, using similar terms. (The GRid identifier also uses abstracted terminology although GRid itself functions on just one level). Note the last column of Table 1, which shows the persistent IDs that are pertinent to each level of abstraction. Unlike the data models, the most commonly used PID standards ISRC, ISWC, GRid, and UPC only represent one level (or at best two). Instead of a coordinated system of PIDs there is a piecemeal approach with minimal interoperability, and lacking common governance. The exception is the MBID (MusicBrainz Identifier), an identifier used by MusicBrainz, an independent music metadata silo that will be described shortly.

[An additional, more detailed level of abstraction describes locative temporal position within a recording. For example, identifying where a section occurs within a particular version of a recording ("starting at 1:12 and ending at 1:27"), so that a soloist can be identified. Or, identifying what section of a song is used in a motion picture, and at what time point in that motion picture it occurs. This can also facilitate the difficult process of identifying multiple-part classical pieces within a single recording. Standards that can be used to describe this include the MPEG-7 part 5 Multimedia Description Schemes (ISO/IEC 15938-5, as used in TV-Anytime), and SMPTE timecode ST 12-1:2008.[20,21] This level of abstraction will become a powerful tool to enable functions such as royalty reporting, audio fingerprint-activated sales, and marketing opportunities. Locative metadata is a topic for future discussion; for now it serves as another example of the power of abstraction.]

The concept of abstraction is essential to discussing a comprehensive descriptive metadata schema for music. Just as the delivery of mail, packages, and people depends on the abstracted addressing system, full utilization of music depends on an abstracted schema. The abstracted mail addressing system has enabled hundreds of years of benefits for commercial, governmental, and private business. Likewise, the music industry needs a common, standardized, and abstracted descriptive metadata schema to enable future growth. The era of one or two physical formats has given way to the era of many digital release formats in more sales channels. The manner in which music is described must evolve as well.

If a common method of describing music were achieved, and if it were abstracted, a platform for innovation would arise to benefit the industry at large. What could come next? Combine this schema for describing objective metadata with additional subjective metadata such as social data, and tomorrow's music systems may utilize automated processes to aid much more powerful discovery than today's simple recommendation engines.[22,23] But without a common path for the music technology sector to exchange descriptive metadata, much development time and money will continue to be spent on redundant schemata.

Reasons for the Lack of Descriptive Metadata

Why did descriptive metadata for music become such a problem? Beginning in the 1980s, the audio Compact Disc revitalized the music industry and was immensely popular. Consumers viewed it as an everlasting and perfect format, full of essential digital information. The CD was none of these things. Despite the CD's shiny countenance, its impermanence was quickly revealed. It could become scratched and unplayable. And more significantly, within the billions of little ones and zeros that recreated audio so faithfully it actually contained very little information about that audio. It merely contained a table of contents that listed the lengths of each track. CD-Text was a failed attempt in 1996 to add sixteen fields to the CD specification. "Unfortunately, CD-Text was introduced more than a dozen years after the original CD and it was not backward compatible… CD-Text was also a Sony and Philips-based standard so not all companies rushed to add it to their CDs".[5]

The lack of descriptive metadata in the Compact Disc specification caused a "metadata vacuum" with future ripple effects. These included many business headaches, and didn't help the decades-old problem of managing royalties. The Compact Disc improved some aspects of music delivery and created a windfall for the record labels, but it didn't fix fundamental information management problems. Dominoes started to fall. Twenty years later when online distribution of music revolutionized the music industry, the tricky problem of metadata resurfaced. And once again, the promise of groundbreaking technology wasn't enough to overcome the industry's tradition of tilting at windmills.

If the Compact Disc standard had been designed from the beginning with a standardized method of embedding metadata, the information could have been authoritative. Workarounds were developed instead, and the CDDB (Compact Disc Database) was the first independent system to attempt to fill the gap. Computer-based music player applications called upon CDDB for metadata. If no previous user had entered data, the user could submit information to CDDB. CDDB was groundbreaking, but it had no way to control the incoming information to ensure that it was accurate. If the first user entered the information incorrectly, every user after them would be presented with that inaccurate information. CDDB offered no way to correct errors in the central database except for submitting a completely new entry for the CD. This created multiple metadata records for individual CDs. Some player applications offered subsequent users a choice between multiple entries, but some did not.

These issues led to a large number of users holding inaccurate or missing metadata, which was passed to derivative mp3 files in ID3 tags when a CD was ripped. Then, these metadata-deprived files ended up in the peer-to-peer file sharing systems of the late 1990s and 2000s, and were distributed widely. Not only were users giving away music, they were doing so with incorrect artist names, song titles and more. For record labels, a possible silver lining in the cloud of file sharing could have been promotion through name recognition. But that opportunity was lost without descriptive metadata.

In the wake of these developments, the music industry needed to offer consumers an easy and legal way to purchase music online. After a period of upheaval including the peer-to-peer network battles of the early 2000s, the stakeholders officially sanctioned online distribution. Numerous services arose to meet the need, including the pioneer and leader iTunes (by Apple), and others including Amazon.

The metadata problem would not have persisted this long if a standardized schema or independent authority had been designed decades ago. These have still not come about. But, a standard language for expressing business arrangements did arise in the late 2000s with the

DDEX suite of standards. The DDEX standards made business arrangements between the stages of the digital delivery chain much more efficient, by utilizing an abstracted model. DDEX will be described in this report, and was examined thoroughly in a previous report.[24] But DDEX does not yet address the descriptive metadata problem. While a number of silos of descriptive metadata have emerged with varying goals and degrees of completeness, there is as yet no definitive authority.[25–30] These silos will be detailed in this report.

The lack of digital music metadata standards has had larger business ramifications. Like a tree with a damaged trunk, industry growth has been crippled. As the model of legal digital distribution became a larger portion of music sales, each supplier of metadata was coming up with their own schema. When each entity needed to communicate with any other entity, tenuous crosswalks (schema translators) were required, or even manual entry. One off-the-record source reported that as of the late 2000s, one sales relationship was still based on mailing stacks of printouts and manual data transcription.

Headaches such as these are causing significant financial and public relations damage. “Misspellings, multiple identities for a single artist, and multiple release dates are costing the music industry a lot of money and causing great confusion among customers.”[31] And, the inconsistent and absent data is alienating the biggest music customers, avid music fans.[32]

This situation sounds like a technical problem. But extensive research and numerous off-the-record interviews have indicated that the biggest hurdle isn’t technical. It is a business matter. The music industry has very few common standards because the major players rarely collaborate. There are just a few underfunded standards bodies to broker peacefully, leading to an environment that stifles innovation in an unnecessarily complex landscape.

Stakeholders agree that there is a descriptive metadata problem. But consensus has not been reached regarding how to fix it. This report examines the keystones to a solution: the need for a standardized descriptive metadata schema, the need for a globally unique abstracted persistent identifier, and a method of quantifying the value of richer descriptive metadata. Without solving these keystone issues, this problem will continue. This report examines each of these topics. First, a look at the landscape of descriptive metadata silos.

The Silos

Descriptive metadata appears in various forms throughout the online music ecosystem. As each service is examined more closely to learn the source of their metadata, five silos emerge. These will be examined to explore two main questions: Can any of these serve as an independent authority on par with the Library of Congress's Authorities? And, can one schema be used as a model for a standard?

The two commercial silos are Gracenote and All Music Guide (AMG). Two open sources are MusicBrainz and Discogs. The Echo Nest is somewhere in between. These silos have different approaches and extent of metadata, a summary of which is presented in Table 2.

Table 2

Summary of Descriptive Metadata Silos

	Gracenote	AMG	The Echo Nest	MusicBrainz	Discogs
Data	Proprietary	Proprietary	Mixed	Open	Open
Schema	Flat	Flat	Flat/Mixed	Abstracted	Flat
Interoperability	Poor		Good	Excellent	Good
Artists			2.6 Million	833,216	3.0 Million
Tracks	130 Million		35 Million	16.1 Million	
Albums		2.9 Million		1.3 Million	4.3 Million

Note. Data adapted from Archival & Contextual Metadata Working Group;[27] Discogs;[33] MusicBrainz;[34] and Echo Nest[35]

From 2008 until early 2014, Gracenote was a wholly owned, independent subsidiary of the Sony Corporation of America.[36,37] Sony Corporation of America also owns Sony Music Entertainment, one of the three biggest record labels.[38] In 2014, Gracenote is planned to be sold to Tribune Company and combined with Tribune Media Services.[39,40] [The sale announcement was made as this report went to press.] Gracenote's metadata silo began as the community-built CDDB, before it was privatized and the name was changed to Gracenote.[32,41] As it is a proprietary system the schema is not available to review. But if the Gracenote database is detailed, it doesn't show up in the Gracenote API (application programming interface) or in the services to which the company licenses data. To all appearances, it is limited to album-level and track-level metadata with no abstraction or deeper relationships.[42] Gracenote's strength lies in quantity: a very large set of metadata and many licensing partners including Apple, auto manufacturers, and Rhapsody.[43,44]

All Music Guide is owned by Rovi.[45] Rovi is publically traded and does not appear to have significant ownership held by record labels. All Music Guide is a proprietary system but has a documented data service and API for accessing metadata which is available on its website.[46] [As this report was going to press, the consumer-facing portion of All Music Guide was spun off as part of the new company All Media Network, while the business licensing and ownership of the metadata was retained by Rovi.]

Gracenote and Rovi are commercial enterprises that gain revenue from licensing metadata to other companies. So, these companies have many more business partners than the non-commercial options. These arrangements are a benefit to their profitability, but are a detriment to their contention as an independent authority. Likewise, it is unlikely that either company would offer their schema for use by the community. In particular, Gracenote's ownership by Sony created a potential conflict.

The Echo Nest is a company with a different approach than the rest. It is a privately owned, for-profit company, yet they have made a portion of their data open and free. It is primarily in the business of analytics. [As this report was going to press, The Echo Nest was acquired by Spotify.] The Echo Nest has built a sizable silo of metadata, including descriptive metadata about artists and songs. But the company has also built a unique data set that combines objective, subjective, and behavioral metadata. The Echo Nest provides infrastructure and data to other music sites such as Spotify, Vevo, Rdio, Twitter, The BBC, and MTV.com.[47] In return, these relationships provide behavioral analytics back to The Echo Nest. This data is then mashed up with automated analysis of songs to create a large set of over a trillion "data points."[35] Like other services, The Echo Nest can categorize music by familiar criteria such as genre and similarity. But what sets the company apart is their unique combination of data, which allows them to provide fresh behavioral insights and new measurements such as popularity, "Artist Hotttnesss," and "Artist Familiarity." The Echo Nest offers contextual and subjective metadata that is valuable to augment descriptive metadata.

The Echo Nest also stands out for their careful balance between proprietary and open data policies. The company offers free access to certain services, including PID resolution from multiple services ("Project Rosetta Stone"), and fingerprinting (i.e. analyzing audio and comparing the resultant signature to a database of known signatures).[48,49] There are certain thresholds (such as API rate limits) over which the free services must be paid for. The company seems to strike a comfortable balance to spur adoption while maintaining financial viability. The well-documented Echo Nest API is "is free for non-commercial purposes. To use them commercially, talk to us and we will go over the licensing options."[50]

For abstraction, The Echo Nest does not seem to go beyond the track level. Based upon a review of the API documentation, the central access points are artist and track, around which most data is related. Albums/release names are data points that are relative to tracks, and don't seem to be a distinct abstraction level. But the data is very detailed in most other respects. In many aspects, The Echo Nest falls somewhere between the proprietary and open silos.

Discogs is a community-created music reference, which is "owned and operated by Zink Media, Inc."[51] Discogs states that "our data will always be open and free to the public."[52] The focus of Discogs is to be a definitive source of information, and an active marketplace for used LPs and CDs. The site is "on a mission to build the biggest and most comprehensive music database and marketplace."[53] Discogs makes a percentage of each sale that is made through the site.

When compared to Gracenote and Rovi, Discogs has good independence. And, according to the data in Table 2, Discogs has metadata for more albums than AMG. Discogs has an active community of editors, detailed guidelines, and an API. But Discogs doesn't have an abstracted schema. The primary entity is the album, and individual tracks are not treated as distinct entities. Discogs is beginning work on track-level metadata as of June 2013.[54, K. Lewandowski, email communication, April 4, 2013]

"MusicBrainz is a community-maintained open source encyclopedia of music information" operated by "the MetaBrainz Foundation, a California based 501(c)(3) tax-exempt non-profit corporation dedicated to keeping MusicBrainz free and open source."[55] It operates as a policed wiki, in that users contribute information, adhering to a strict set of editorial and stylistic guidelines. "The factual user-contributed information about music in the database is public domain, while non-factual information (e.g., folksonomic tags and annotations) and the live data feed are licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.0 license."[41] Contributions are subject to a community voting approval process. The MusicBrainz database has been populated by over nineteen million edits by over seven hundred thousand users.[34]

MusicBrainz is notable for following many good practices. It is the only open silo with track-level metadata. MusicBrainz has mechanisms in place for advanced discovery and cataloguing. It launched a fully abstracted model in May 2011 called the "Next Generation Schema," which allows for extremely detailed description, very granular relationships, and powerful searching.[17,56] This complete schema reboot was a vast improvement. See Table 1 for abstraction examples, and Figure 4 for the core database tables.

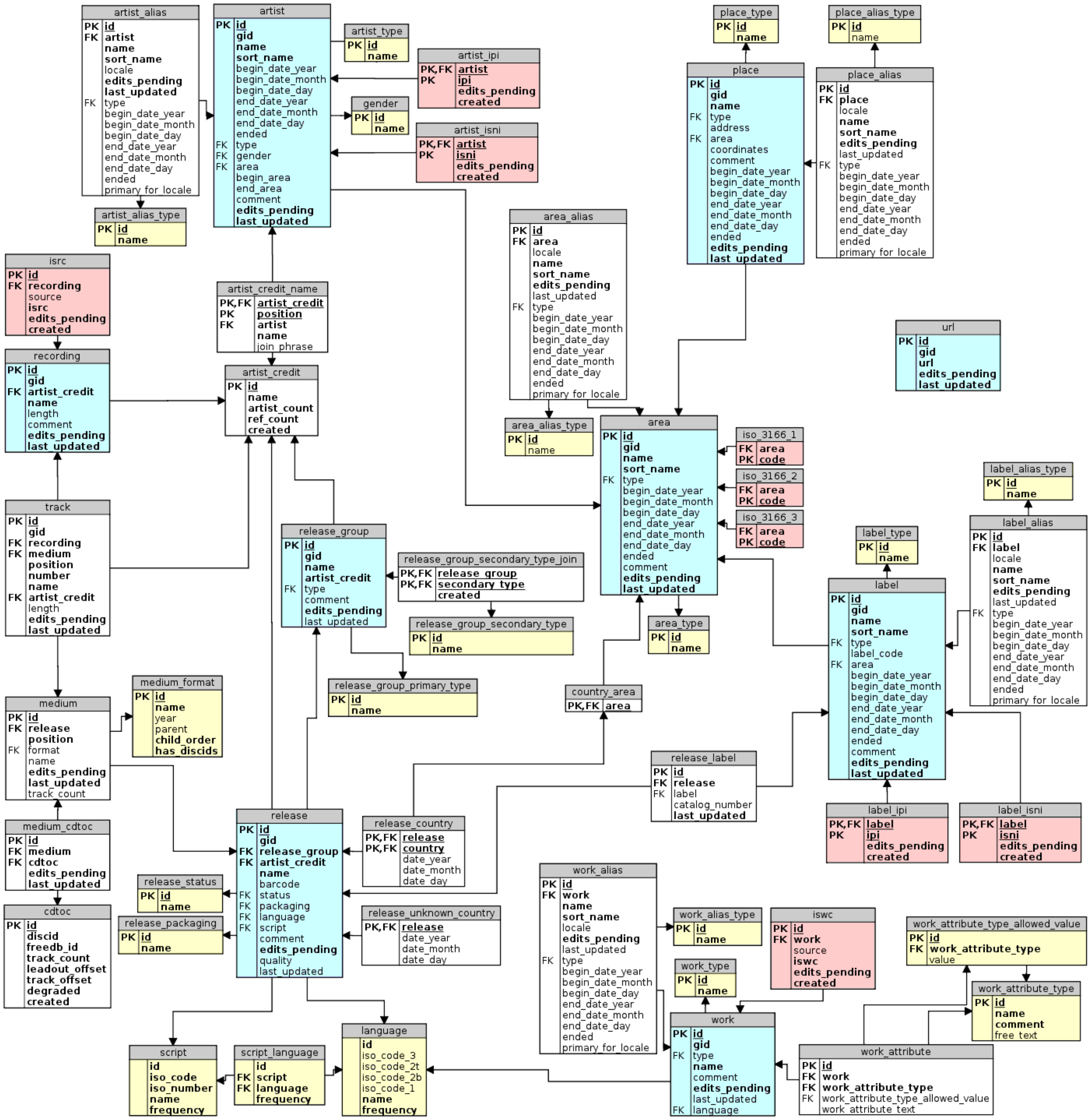

Figure 4. The MusicBrainz core database tables as of 26 October 2013, showing relationships between core entity types (indicated in blue).[56]

MusicBrainz employs a model in which almost everything is treated distinctly. Each type of entity (e.g. "artist" "track," "release"), and each instance of each entity (e.g. "Paul Simon," "Dixie Hummingbirds," "Loves Me Like A Rock," "There Goes Rhymin' Simon"), is distinct for the purposes of searching and linking. This aids discovery immensely. In MusicBrainz tracks have multiple abstraction levels ("track" and "recording") to distinguish between multiple appearances of the same recording on different releases. In a separate dimension, albums also have multiple abstraction levels: a "release group" aggregates multiple "releases" which can include different variations. These variations include different distribution "mediums" (LP, CD, etc.), different re-releases (a new record label, a version with bonus tracks), and remastered albums.

The MusicBrainz schema also allows for amazingly detailed relationships between tracks, producers, guest artists, and musicians.[57] For example, on The Beatles album "Abbey Road," track-level relationships include producer, composer, lyricist, string arranger, and who played what instrument on each song.[58] Exploring this album's entry reveals fully relational connections between remasters, cover recordings, record labels, catalog numbers, and every format in which the album has been released. The MusicBrainz schema allows for very detailed credits such as whether a vocalist is considered "lead," "background," "additional," "guest," and/or "solo." The schema also includes an "Artist Credit" concept, allowing collaborations to be linked to individual artists, with authority-ready "see also" references.

The relationship-based MusicBrainz schema is positioned perfectly for the advent of the semantic web and linked data. The MusicBrainz Web Service uses the MusicBrainz XML Metadata Format (MMD, a RELAX NG schema) to represent music metadata with a declared namespace supporting many elements including semantic relationships. It is fully documented.[59] A description of the semantic web is beyond the scope of this report, but experts in the library and technology communities have predicted that semantic content such as this will be as revolutionary as the Internet itself. By interconnecting data on a more detailed and machine-readable level, applications can interact directly with multiple databases to create new meaning.[23,60,61] [For concise introductions to semantic data, see Linked Data Tools[62] and a TED Talk by Tim Berners-Lee.[63]] The machine-readable structure of MusicBrainz is very powerful and forward thinking. In fact, this is the second generation of linked data on MusicBrainz (replacing an RDF-based format). With this comprehensive infrastructure MusicBrainz has been a pioneer, planting a flag for the next generation of music discovery.

For extensive interoperability with other systems, MusicBrainz offers a comprehensive metadata crosswalk table, which maps in detail how sixty-five MusicBrainz metadata elements can be translated to and from equivalent elements in the following metadata schema: ID3v2, iTunes MP4, Vorbis Comment, APE v2, and Windows Media.[64] This table is a model for how almost any silo could interact with each other, if only there were a common schema serving as the *lingua franca*. Downloads are also available of the entire MusicBrainz database as a data dump, and a pre-configured virtual image of the MusicBrainz Server for local replication.

In addition to these technical strengths, MusicBrainz appears to be completely transparent regarding its governance structure and finances. Their work has been done on a fraction of the budget of the commercial services. MusicBrainz's funding comes primarily from donations and commercial licensing of their data feed. The 2011 schema reboot shows significant technological progress, and licensing deals have followed. Recent announcements of high-profile licensing customers such as AOL Music, The BBC, Echo Nest, 7Digital, and The Guardian (UK) are signs that MusicBrainz is building relationships to further their mission.[65,66] But unlike the vast majority of the music industry, MusicBrainz is beholden to no one, and without financial encumbrance.

MusicBrainz's main weakness is the number of entries in their database so far. The 16.1 million tracks in their database is a smaller count than the other silos.[34] However, quantity is less important than the measure of quality. MusicBrainz values quality highly, as shown by a voting approval system that weeds out inaccuracies, and a "Data Quality" measure (which is distinct from the user rating of a release's artistic merit). With the MusicBrainz abstracted schema in place, the most difficult job has been done. A foundation has been formed for healthy growth. All that remains is to build upon this to match the quantity of the other silos.

In short, MusicBrainz is neutral, open, and extremely comprehensive in structure. With 16.1 million tracks, strong quality control, a comprehensive schema, and an adamantly independent value system makes MusicBrainz by far the strongest contender as an independent authority. Based upon multiple on- and off-the-record interviews, the main issue that that would prevent stakeholders from agreeing to MusicBrainz as the independent authority is the crowdsourced nature of the data. Some decision-makers still want stronger proof, despite the fact that MusicBrainz editors are well vetted, the data is very accurate, and corrections are easily made. This may partly be due to fears that crowdsourced data would interfere with payment streams. This is an unfounded worry for two reasons. First, if the authority is merely a descriptive metadata authority, not a performing rights authority, then any data errors would not be mission-critical. Second, if a stakeholder discovers an error in the MusicBrainz descriptive metadata database, they can simply correct it. This is not possible with less accessible systems.

Still, the focus on achieving a central authority is not the best objective anyway. Of more significant importance is the incredibly well designed MusicBrainz schema itself. The MusicBrainz schema may prove to be more important than the MusicBrainz data. Once the difference between an authority and a schema is more widely understood, the schema will be better appreciated. In fact, the MusicBrainz schema may very well be the key to the music industry's metadata problem. This will be addressed further shortly.

Another source of descriptive metadata is FreeDB, which is a much less organized collection of metadata than any of the previous silos mentioned. It originated at the same time as

MusicBrainz and is reportedly active, but has not been built out very much. It is a niche system that connects to a few less popular music player applications.

These silos offer various levels of API access, which allow applications to tap into their data. Gracenote, AMG, The Echo Nest, MusicBrainz, and Discogs all have APIs that offer dynamic access to metadata.[41,46,50,65,67,68] This interoperability is essential for the music ecosystem, and provides income to the silos. These APIs allow many online music services such as Rdio, Spotify, Rhapsody and SoundCloud to pull metadata from one or more of the silos. For example, the Rhapsody streaming music service gets descriptive metadata from Gracenote.[44] Apple's iTunes pulls some album reviews from AMG, and uses Gracenote to power features such as iTunes Genius, Match, and CD lookups.[43] Music services by the BBC, AOL Music, Last.fm, and 7Digital get metadata from MusicBrainz.[41,65,66] A full comparison of each silo's API access is beyond the scope of this report, but in general the more proprietary a service is, the less open and documented the API is. [It is worth noting that this research was extensive but conducted without the complete access to the proprietary services that a paid customer would receive. It is possible that these services have more extensive functionality, but there are no signs to indicate so.]

Having examined each of the silos, it appears that none of them will suffice as an independent authority, although MusicBrainz is very close. Previous commentary has let concerns about the validity of an authority obscure the need for a standardized schema. Before an authority can be effectively discussed, a logical first step is to determine a language for descriptive metadata that all parties can use. This can be achieved through an agreed-upon standard schema.

The DDEX Suite of Standards and CCD

Another initiative, the DDEX suite of standards, is a significant achievement and central to industry progress. A recent report found that choosing DDEX standards over previous methods produced large cost savings, higher labor productivity, and sales channel efficiency gains.[69] In a broader context, the DDEX standards have proven the value of working toward a common standard. But, the DDEX standards are not designed to solve the descriptive metadata problem. DDEX messages carry a limited amount of descriptive metadata, just for enabling and confirming automated processes.

For example, in the DDEX "Release" profile, a track's composer is only mandated for a Classical album.[70] The composer is not mandated in other non-classical profiles, and in the classical profile it is not on a track-level granularity. This is because for the limited purpose of identifying an album release for distribution, this information is not needed. Tracking of royalties is not needed until after a purchase is made. For that, we turn to a separate profile in which "composer" is an allowed value in the "SalesReportToSocietyMessage."[71]

The DDEX standards rely upon a persistent identifier to identify a release, and dictates that it be either a Global Release Identifier (GRid) or ICPN.[70] The International Code Product Number (ICPN) for physical products is exemplified as a UPC code in the United States, and an EAN in Europe (N. Rump, personal communication, April 11, 2013).

As the DDEX standards rely upon GRid for digital releases, does that in turn connect to rich descriptive metadata? The descriptive metadata about the recording is a bit farther down the rabbit hole. "A GRid shall be associated with a specified set of data elements (see normative Annex B) describing the Release it identifies. This set of data elements is designated the Reference Descriptive Metadata."[15] Are we there yet? Unfortunately, the Reference Descriptive Metadata set of metadata elements includes just two descriptive elements, "Title" and "Main

Artist." The remaining seven elements are administrative, such as whether the release is in a particular sequence and if so, it includes an ISRC code for the Digital Resources that make up this Release.[15]

This shows the importance of a persistent identifier for connecting to descriptive metadata. GRid and other persistent identifiers will be covered in much greater detail in a later section of this report.

DDEX is powerful for tracking sales, but it has not provided a schema for descriptive metadata. To address this, an additional DDEX descriptive metadata standard is being developed. This will be based upon a previous project called CCD (Content Creator Data), a venture of the company BMS/Chace, The Library Of Congress, and The Recording Academy.[28,72] The CCD project is now held by DDEX.

CCD is a common framework for metadata generated during the various production phases of a recording project including recording, mixing, and mastering. CCD is an XML schema with an accompanying data dictionary with hundreds of elements. It enables exhaustive documentation of personnel, credits, equipment, and media in a form than can be handed off from recording to mixing to mastering to distribution. A prototype front-end was also developed for data entry, but the significant deliverable result of the CCD project was the schema.[73] It is essential to document this production metadata while work is in progress, so that it may be carried forward to when a recording is released. But to fully address the larger issue of descriptive metadata facing the industry, the CCD schema would also need to describe the complex interrelationships between works, expressions, recordings, and releases. Without an abstracted model, CCD can't describe released music as well as it can describe music as it is being produced.

The success of DDEX so far has proved a very important point: The music industry can sit down together to create a standard. But, stakeholders will only do so if the collaboration can be financially justified, and if the benefits are measurable.

So far we have seen many impressive approaches that each address some of the music industry's descriptive metadata problem. But no single solution has pulled all of the required components together: an abstracted schema, independence, stakeholder buy-in, comprehensiveness, and documentation of the complete creative process from production through release.

[Part Two of this report will: detail the reasons why the descriptive metadata problem has remained unsolved; provide counter arguments against richer descriptive metadata; propose a new "Globally Unique Abstracted Persistent Identifier" (GUAPI); propose a study to quantify richer metadata's ability to increase music sales; and conclude with a clear path to solving the problem through a standardized schema and a GUAPI.]

Part Two

[In Part One of this report: the music industry's descriptive metadata problem was introduced with examples and a brief history; terminology was explained, including the core concept of abstraction; the current landscape of descriptive metadata silos was detailed; and current standards were introduced.]

Why Hasn't This Been Fixed Yet?

With so many previous attempts, why is the problem of descriptive metadata still unsolved? What are the hurdles that have obstructed progress? We will now look at some of the issues that could explain the holdup.

Why has richer metadata not been implemented already? Perhaps the business case has not been made. One significant factor that affects any business decision is the financial benefit of implementing a new system. If user experience is improved by the inclusion of richer metadata, a competitive advantage would yield a financial benefit. A more engaging user interface leads to increased sales. These are instinctive conclusions, which also have scientific proof. It has been shown that in library catalogs, richer metadata leads to greater circulation and plays a key role in discovery. Multiple studies have shown the positive effect of enriched records on search results. More pertinent, a 2011 study by Tosaka and Weng controlled for previously uncontrolled factors and showed that when users encountered content-enriched metadata records, they were more likely to select those items. When sample proportions were controlled for, "the effect of enhanced records was overall positive, with approximately 30–55 percent higher circulation than those with nonenhanced records."[74] These findings are recent so they might not be known yet. It is also possible that, as the studies regarded libraries rather than music downloads, the music industry has not learned of them. A study specific to a digital music download store is also proposed later in this report.

Could a technical argument be made that including this added metadata would add to the file sizes and bandwidth, making these files more expensive to store and serve? To examine this, a test was administered using All Music Guide's "credits" tab for a person and for an album. The following metadata sets were measured for their size as rich HTML pages, as Excel files and as text files.

According to AllMusic's discography, Phil Ramone's career includes 967 credits.[7] When this entire page was saved as a local html file, the file was 942k. This included all page elements such as similar albums and site navigation. When just the credits were copied into a text file, it was merely 45k.

Another recent album, "2012 Grammy Nominees," is a compilation with 105 people listed in the credits. This album contains twenty-two tracks by twenty-two different artists, thus has many more people listed than the average album. Yet, when this page was saved as a local html file, it was only 111k. When saved as a text file, the metadata was 8k. The results are presented in Table 3.

Table 3

Storage Size Comparisons of Descriptive Metadata Sets

	2012 Grammy Nominees	Phil Ramone Discography
Number of credits	105	967
html size	111k	942k
Excel size	57k	82k
text size	8k	45k

Note. Data adapted from multiple sources[7,75]

So, the 105 credits from a 22-track compilation album can fit into an 8k text file, and a 967-credit legendary career can fit into a 45k text file. A single digital download song's credits would be even smaller. A typical song file is multiple megabytes, which is thousands of time larger than the minuscule metadata. Therefore descriptive metadata does not significantly impact storage or bandwidth costs. Of course this is an oversimplification, because there would be additional overhead for file headers and other administrative structure. Still, the size of metadata is not a reasonable argument against including richer information.

Another hurdle is the lack of track-level metadata. This means having each track on an album identified as an entity, rather than simply identifying the album as a whole. Most first-generation music metadata silos were not abstracted, focusing instead on just one descriptive level, usually the album. This is another legacy holdover from the pre-download era when music was predominantly sold as albums. Track-level descriptive metadata is essential because many albums have a variety of musicians, producers, and engineers involved on each track. More than simply listing the tracks on an album, true track-level metadata means each track must be its own independent entity.

All but one of the silos only have metadata associated at one level, usually album level, rather than truly abstracted metadata. Most have a partial implementation of this, such as album-level metadata that also lists the names of the tracks on the album, but no distinct database entity for each track. Discogs has just begun work on implementing track-level data.[54] Gracenote offers audio fingerprinting services for identifying tracks, and their developer API documentation infers track-level metadata. But it appears to use the album as the main organizational data point.[42] The Echo Nest has track-level data but not album level entities. MusicBrainz fully implemented track level metadata in 2011, completing their abstraction to include metadata for work, track, album, release, and more.

Another challenge that online music services face is to offer richer discovery through metadata while retaining a user-friendly interface. An argument against offering more metadata is that it could complicate the user's experience. But this is a minor issue, one that has been handled by libraries for many decades. Library catalogs often separate the basic information presented to the user from the deeper index of searchable terms. The complete set of a resource's search access points are rarely displayed on the first detail page. Instead the richer data is viewed via a tab labeled "more info" or "full record." A rich music discovery interface could present basic info upon initial user access, and expand upon command to reveal deeper credits. This way, both goals of a comprehensive search and a clean interface are achieved. Sometimes, certain fields of data are not shown to the user at all, and are just used "behind the scenes" to aid machine-based indexing. The user benefits indirectly from these fields. For all of these reasons the addition of richer metadata, if managed wisely, can only enhance the user experience.

So, some technical arguments against including richer descriptive metadata have been discounted. It is a reasonable assumption that richer metadata would lead to greater sales. There exists a fully functioning independent authority and comprehensive schema in MusicBrainz. Technical hurdles are not the primary problem. The next category of hurdles to examine is political. What business reasons have kept the industry from agreeing upon an independent authority of descriptive metadata, or settling upon a standard schema for communicating it?

A factor that is partially technical but largely a business decision is determining the validity of identity. (This only applies to an authority, not to a schema.) A common descriptive metadata authority would need to be policed in some way to ensure accuracy. There is a wide spectrum of approaches to this, from the "anything goes" approach of Wikipedia to a centrally controlled authority such as the Library of Congress' Name Authority. Neither of these extremes solves this problem. Too little oversight means inaccuracies. But too much manual control would be impossible with the sheer volume of metadata that needs to be created and maintained. It is understandable that stakeholders may be reluctant to become involved with a metadata silo at either end of this spectrum.

Somewhere in the middle, MusicBrainz offers a reasonable compromise between validation extremes. Edits must meet detailed requirements, and must pass a voting process of approval by other users before they are committed. Data is measured for quality. The pool of editors is itself policed. Users who have proven over time to be trustworthy are granted preferred "auto-editor" status by an election process. This role is not handed out casually. Only 227 individuals out of over 700,000 editors have reached this status.[34,76] Transparency helps these processes remain effective, and incorrect data that does slip through is easily corrected. And, if a stakeholder wishes certain information to be entered or corrected, they may simply join in and do it themselves. An example of direct access is the mutually beneficial relationship forged between the BBC and MusicBrainz. The BBC uses MusicBrainz data to enrich their site, and BBC representatives have editing accounts.[66] Any stakeholder can participate. Instant access plus rigorous standards and a tested vetting system create the best compromise.

It is also important to offer methods to update descriptive metadata. But the closed systems of Gracenote and Rovi do not offer sufficient methods to submit new information and corrections. This limits their ability to stay current and causes costly internal editorial processes.

One factor impeding progress may be that the stakeholders have too much invested in their proprietary silos of descriptive metadata to be interested in collaboration. To examine this, it is worth asking, what is the value of metadata as intellectual property? Some perspective can be gained by examining a few recent acquisitions. Sony Corporation of America bought Gracenote in mid-2008 for $260 Million.[36] For a relative picture of the size of these companies, a few months later Gracenote's new sister company Sony Music Entertainment (the music division of Sony Corporation of America) bought out the remaining half of Sony BMG (from Bertelsmann) for $900 Million.[38] That puts Sony BMG's value at about $1.8 Billion, and Gracenote at $260 Million. Comparing these two values, Gracenote was valued at a significant amount compared to the value of a major record label. Either Gracenote was highly overvalued, or Sony saw significant revenue potential in the metadata silo. This transaction speaks to the value of metadata. It also reveals the perceived value in keeping metadata proprietary. A reasonable theory could deduce that it is not in Sony's interest to promote adoption of alternative authorities that would interfere with the profitability of Gracenote. Other major record labels maintain internal silos of metadata for similar purposes, so they may seek to maintain control over the information for as long as possible. The data is, after all, very important. But this may be in flux, as Sony sold Gracenote for $170 Million in early 2014, to a company primarily involved in content recognition for video.[39,40] The loss in value and the adjustment to the company mission may indicate a sea change.

The old paradigm was to keep data locked down. Companies have tried to hold on to descriptive metadata as long as possible to profit from their unique data set, often by licensing access to the data. But that approach is a ghost from the days of physical music formats. That mindset is slowly being replaced with a model of open access and smoother metadata interchange, which fosters business in other ways. Once the walls come down, businesses benefit from cross-promotional opportunities, lower expenses, more direct consumer relationships, and valuable data analytics. The public benefits from better service and lower cost. All benefit from increased efficiencies. We saw this over the last decade as consumers benefitted from the disintermediation of the travel industry. Travel agent middlemen were replaced with services that connect consumers to companies by means of more efficient metadata interchange. In the case of music, when the item being sold is digital rather than physical, middlemen are even more redundant.

Additional business opportunities are fostered by smoother data exchange. David Weinberger has named the business of third-party information “meta-business.” Apple has built a business model from making the content owned by others more searchable through descriptive metadata, even while working with a limited metadata set. By contrast, Pandora, Last.fm and others have created personalized discovery interfaces, where rich metadata “introduces users to songs they might never have stumbled across, with a far greater likelihood that users will like what they hear– and perhaps purchase the track.”[77] Each service is creating a market upon others’ intellectual property by building innovative interfaces. However, this could be viewed as another form of middleman. Many valid criticisms have been made against the new digital music services, and the amount of money that makes it through to the artist. Time will tell whether these new services will survive this transition while paying their fair share. All of these new services have had to reinvent the wheel each time, spending capital on proprietary infrastructure rather than on royalties. The first step toward a more efficient marketplace is to build a common infrastructure upon standardized schemata.

An essential point to be made is that the music industry’s common descriptive metadata is not copyrighted intellectual property. Unlike the music itself, basic metadata about the music is not protected. What gives the Gracenote and Rovi silos their value is the proprietary nature of their data sets, not the inherent value of the metadata itself. What would happen if a large entity such as Apple or Amazon were to switch to a richer source of metadata that was also less expensive? Would they sell more downloads while simultaneously cutting expenses? What if there was a common schema for new startups to do business on the same playing field as the old guard? What if every stakeholder spent less money on infrastructure, spent more on building unique consumer experiences, and had more left to pay artists?

Toward A Globally Unique Abstracted Persistent Identifier (GUAPI)

An additional keystone issue to be addressed is persistent identifiers (PIDs). There are PIDs in use today that serve individual abstraction levels, such as a Globally Unique Identifier (GUID). Some current systems include a mechanism for partial abstraction, such as a portion of the alphanumeric string that represents a higher level in a hierarchy. Examples of this include top-level domain extensions of the Domain Name System (.com, .org, .biz), and the two-character “country code” portion of an ISRC. But for describing creative works such as music, a globally unique persistent identifier that is designed to operate at multiple abstraction levels is necessary to allow true distinction. This would allow accurate linking of entities in many systems including player applications, metadata silos, or an authoritative source of descriptive metadata. And a standardized schema would certainly include elements to record identifiers.

This proposed identifier will henceforth be referred to as a “Globally Unique Abstracted Persistent Identifier,” or GUAPI. If developed and standardized, a GUAPI could point to descriptive metadata at multiple abstraction levels including composition, recording, and release. Refer again to Table 1 for the abstraction models of current PIDs at each level. If this were truly forward thinking, it could also include a level of abstraction to describe locative time within media. (This identifier would not necessarily need to address the abstraction level of a specific item sold to a single consumer, but this level of abstraction could be included.)

Currently, a PID in widespread use is the ISRC (International Standard Recording Code), which was originally adopted in 1986, and ratified in 2001 as International Standard ISO 3901:2001. ISRC is governed by the International Federation of the Phonographic Industry

(IFPI). An ISRC consists of a country code, a registrant code, the year the ISRC was issued, and a five-digit designation code. It has a maximum capacity of 46,656 registrant codes per country, but each registrant can create 100,000 ISRCs per year. Only the years 1940-2039 are allowed.[78] Therefore, ISRC cannot represent recordings issued before 1940, and will not represent recordings issued after 2039. It is worth noting that before final ratification of the ISO standard in 2001, the year element was also used to describe the year the track was recorded.

After decades of development, ISRC still lacks even a simple reference database of descriptive metadata that can be queried for distinction between similar entities and for conflict resolution. This critical problem fundamentally cripples the standard, as there is no way for parties in the digital delivery chain to verify an ISRC's referent. Considering that it took from 1986 until 2001 for ISRC to become standardized, and that there is still no way to query the ISRC registry as of 2014, planning should begin now for the replacement that will be needed by 2039.

ISRC is not abstracted, instead representing the track level. This makes it unable to aggregate multiple versions of a composition, or aggregate re-released tracks in new packages. The ISRC is comparable to a zip code, in that it is much less useful without the additional context of an abstracted system of states, cities, and street addresses. Therefore systems must also rely on other identifiers such as the under-used ISWC for the composition, and UPC for release packages.

Compare this to the MusicBrainz Identifier, called MBID, “a 36 character Universally Unique Identifier that is permanently assigned to each entity in the database, i.e. artists, release groups, releases, recordings, works, labels, areas, places and URLs.”[18] MBID is abstracted at multiple levels, from composition to recording to a particular release. MBID is notable in that it is also used to identify artist entities and labels. MBID is openly available as a Uniform Resource

Identifier (URI), by appending the MusicBrainz base URL with the entity type and the MBID. Because the MusicBrainz database allows for entry of an ISRC, ISWC, UPC/EAN barcodes, ISNI, and/or an IPI, translation between MBID and all of these PIDs is possible. [These acronyms will be explained below.]

The MBID is unlike ISRC in various ways. MBID is randomly generated, rather then being structured as ISRC is. An ISRC contains a code for the registering organization and contains a year. MBID is not controlled by a system of registration. Unlike ISRC, MBID has a database of descriptive metadata (the entire MusicBrainz database) that can be queried to identify recordings. These differences can be considered positive or negative depending on perspective. A direct comparison of MBID and ISRC is not quite fair, because MBID has been developed independent of commercial stakeholder input, while development of ISRC has been constrained by the governance process that is required for stakeholders to agree to a standard. Nevertheless, MBID serves as an example of what could be achieved if standards bodies would move faster, prioritize abstraction, and consolidate the roles served by the current superfluity of PIDs.

> "The Global Release Identifier (GRid) Standard was originally developed by the member organisations of the Recording Industry Association of America (RIAA) and the International Federation of the Phonographic Industry (IFPI) as part of the Music Industry Integrated Identifiers Project (MI3P)… for the exchange of information between record companies, rights societies, music publishers, electronic retailers of music and other interested parties on an international basis… [GRid] identifies Releases as abstract entities representing bundles of one or more Digital Resources compiled for the purpose of electronic distribution. It is not used to identify any specific Product which contains

such a Release, or individual instances of the Release. Such Products and instances may be the subject of separate standard or proprietary identification systems."[15]

"[GRid is] a system for the unique identification of "Releases" of music over electronic networks, so that they can be managed efficiently. A Release is defined precisely in the Standard but can be understood as a collection of recordings or other media that are grouped together for commerce… By assigning a unique GRid to a Release, it can be identified without ambiguity in, for instance, reports of sales of products based on the Release."[79]

So, GRid is designed as a globally unique identifier to augment ISRC. But it primarily addresses just one level of abstraction, has not been widely adopted yet, and does not have a rich database of descriptive metadata. GRid does not even aspire to become abstracted.

To further complicate matters, there are two very similar acronyms that must be distinguished. The Global Release Identifier (GRid) was just described. The Global Repertoire Database (GRD) is a separate initiative projected to be completed in 2015, and is designed "to provide, for the first time, a single, comprehensive and authoritative representation of the global ownership and control of musical works."[80] GRD is being designed to track the extremely complex web of music licensing, rights ownership, and licensing authority information for rights holders across all world territories.[81] GRD is not creating a descriptive metadata database, and it does not appear to be suitable as a GUAPI. As of May 2013, GRD is in the final planning stage, and about to enter the technical build stage. As GRD and GRid will operate in related spaces, the acronym similarity will undoubtedly cause confusion. Any further confusion in this environment would be detrimental to say the least, so perhaps the GRD would gracefully consider changing its name.

ISWC (International Standard Musical Work Code) is a persistent identifier approved by ISO (International Organization for Standardization) that was designed by CISAC (International Confederation of Societies of Authors and Composers). ISWC is intended for the "tracking and exchange of musical works information. (e.g. Registration, Identification, Royalty Distribution, etc.)… The ISWC identifies musical works, not their manifestations, objects, or expressions. (e.g. publications, broadcasts, etc.) The ISWC will not identify recordings, sheet music or any other type of performance associated with the musical work."[13]

ISWC and ISRC are operated independently by political opponents that do not collaborate well. ISWC is governed by CISAC (representing publishing rights organizations) and ISRC is governed by IFPI (representing record labels). Due to a tense "balance of power" between CISAC and IFPI, interoperability of ISWC and ISRC is unlikely. The domains that these two IDs represent, however, are very interrelated. A single composition can be expressed through many recordings. But a recording generally only expresses one composition. (There are exceptions, of course, such as medleys and mashups.) Conceptually, there is a one-to-many relationship between ISWC and ISRC respectively. It would be logical to be able to refer to the corresponding ISWC from a particular ISRC. Unfortunately, there is currently no field in the ISRC registry for an ISWC. If this were added to the ISRC standard as an optional field, a number of interoperability benefits would result.

First, it would open up avenues for service innovation. For example, if a system that uses ISRC as its central identifier could query the ISRC registry for the corresponding ISWC, then it could more efficiently refer users to information about other recordings of this composition. From an administrative standpoint, a query of the registry could provide results grouped together by ISWC, putting covers or live versions of a track side-by-side in results. This would ease the administrative process of distinguishing recordings with identical titles. It would enable a pseudo-abstracted connection between ISRC and ISWC. And it would increase adoption of both standards. Prioritization of interoperability such as this is a recommended best practice in modern information science theory.

ISNI, the International Standard Name Identifier (ISO standard 27729), is a unique, persistent 16-digit code that identifies persons and organizations that contribute to creative works. Authors, musicians, characters, technicians, and companies are managed across multiple disciplines. Identities, pseudonyms, and aliases are actively managed in definitive authority records represented by unique numerical identifiers. "ISNI can be assigned to all individuals and organisations that create, perform, produce, manage, distribute or feature in creative content including natural, legal, or fictional identities."[82] So, a songwriter who shares the same name as an author can be disambiguated. Or, a musician who also is an author can be identified as being the same person. As of 2013, there are over 6.5 million identities in the system.[83] The ISNI system was built by a unique collaboration between organizations in the rights management societies and library communities, including the International Confederation of Societies of Authors and Composers (CISAC), International Federation of Reproduction Rights Organisations (IFRRO), the International Performers' Database Association (IPDA), Online Computer Library Center (OCLC), The British Library, the Conference of European National Librarians (CENL), and ProQuest.[84]

The Interested Parties Information Code (IPI) is an older PID that is similar to ISNI, built to identify authors, composers, arrangers and publishers. IPI is designed for music rights management and is used by ISWC.[85]

These many PIDs create an ecosystem of identifiers that serve different purposes. This diversity of specialized identifiers means that each can address their specific topic. As shown above, music requires description on different levels of abstraction. But instead of a unified system the music industry has developed separate PIDs for each level of abstraction, specifically ISRC, GRid, and ISWC. This piecemeal specialization is limiting rather than empowering. Unless a standardized and coordinated GUAPI is developed to replace these PIDs, we will be left with the current mashup of persistent identifiers. This piecemeal approach has created an overly complicated mess, and has proven to be a shaky foundation to innovate upon. Returning to the metaphor of the postal addressing system and the ZIP code, imagine how much more difficult mail operations would be if each U.S. state used their own ZIP numbering system. Without central coordination of a single numbering schema, ZIPs would repeat and operations would be impeded by redundancies.

An important facet of the persistent identifier topic is whether the identifier is truly persistent. Proprietary PIDs, while not constrained by the limitations of ISRC, are much less likely to be persistent. One example of this regarded Apple's iTunes service, the biggest digital download retailer. It was reported in 2012 that,

> Whenever a label switches its distributor, iTunes removes the label's entire library of content and forces the new distributor to resubmit the music and its metadata all over again, simply because Apple assigns each title a new code number in its internal system. When that happens, all sales history, listener reviews and outside links to albums are deleted, along with any search algorithm characteristics that the titles have built up.[86]

This example regarded an internal proprietary numerical ID system, not an industry standard. Of course it is Apple's prerogative to use their internal systems as they wish. But if they and their competition were to adopt a standardized GUAPI used by all parties, problems such as this could be eliminated.

Industry standards such as ISRC are a different matter than internal numerical identification systems. In order to be relevant, a standardized PID should be truly persistent.

However, according to multiple personal communications with industry leaders, it was reported that an ISRC could change in certain circumstances such as when a catalog of recordings is sold between companies. But the official ISRC Handbook flatly disallows this, stating “The ISRC must be retained irrespective of when or by whom the recording is manufactured, distributed or sold.”[78] The ISRC FAQ states that only artistic changes to a recording such as a remix, editing or remastering triggers a new ISRC. "[Question:] Our company has just acquired the rights to a recording that already has an ISRC. Do we have to apply for a new ISRC for this recording? [Answer:] No. The ISRC remains the same, regardless of changed ownership… changes in ownership do not affect the ISRC.”[87] It has also been reported that ISRCs have been generated and reused inappropriately. These problems defeat the entire purpose of a PID. If the rules are not being followed, consequences should result such as invalidation of affected ISRCs and registrants. Regardless of the stories behind these ISRC irregularities, any confusion undermines the adoption and usefulness of the standard. Uncertainty and doubt need to be answered with cooperation and open communication.

An impediment to ISRC use is the lack of standards dictating how an ISRC should be embedded in digital files. The Broadcast Wave Format (BWF) audio standard (a metadata-enriched version of wav used extensively in audio and video production) has existed since 1997, yet the manner in which ISRC is embedded in a BWF file was not standardized. It wasn’t until August 2012 that the EBU (European Broadcasting Union) issued a recommendation regarding where and in what form the ISRC should be stored in a BWF file.[88] Without clear guidelines for how identifiers are used, ubiquity is impossible.

A GUAPI must be standardized. Without a common key, all descriptive metadata silos will remain one-dimensional, disconnected, and redundant. Future revisions of ISRC, ISWC, and GRid need to become more interrelated by including references to each other. Better yet, the industry would be best served by a merger of these PIDs into a single coordinated standard that retains the intended purposes of each. If this is not possible, digital services will continue to use their own proprietary PIDs. These “end-runs” around the standards defeat the purpose of having standards in the first place, and impede adoption. For example, a developer building a new service may choose to use the MBID because it is functional today, meets the essential criteria for abstraction and access, and has a flexible governance structure to allow for further improvement.

One argument against creating an abstracted persistent identifier might be that separate identifiers are more easily managed. However, the current ecosystem of multiple identifiers has been quite difficult to manage, and it seems logical that a single system would reduce overhead. At present, each identifier has separate registration agencies responsible for each territory. Surely a coordinated system would allow for more efficient management of technical infrastructure, registration agencies, and governance?

A second argument against an abstracted identifier might be that function specificity is essential to persistence. Would an abstracted identifier be vulnerable if just one level of the hierarchy was broken or needed replacement? Perhaps the abstracted system could be built such that each level of the hierarchy could be addressed as a distinct entity, similar to an XML namespace. Yet the levels would be coordinated to allow interconnection. The levels would need to very carefully designed to provide for a certain amount of modularity. The argument of monolithic vulnerability also forgets that the current system is already compromised. As it stands now, there are multiple PIDs representing the levels and not all function adequately.

A reboot would provide the opportunity to retain successful aspects and rebuild problems. It took decades to learn many lessons about what works and what does not. That knowledge would be carried forward in the evolution of persistent identifiers, while legacy problems could be shed. As stated by Rust and Bide in the 2000 <indecs> framework,

> Ultimately it is only the deployment of unique identifiers across a wide range of critical pieces of metadata – well beyond what is currently practised – which will allow trade barriers to be surmounted without an uneconomic level of human intervention and interpretation… but as things stand today these systems risk, unintentionally, finding themselves in competition to no good purpose.[19]

Proposed Study: Quantifying Descriptive Metadata Value

The financial argument for developing an independent descriptive metadata schema and a GUAPI depends upon an assumption that richer metadata based upon the abstracted model would spur more sales. So, a study is proposed to measure this quantifiably.

Research Questions

It has been shown that richer metadata in library catalogs leads to greater circulation and plays a key role in discovery.[74] It has also been shown that effective metadata needs to not only be deep and plentiful, but also of sufficient quality.[89] Errors compromise results, and particularly affect the use and discovery of digital resources.[90] This previous research suggests that discovery, usage, and circulation of print materials are highly dependent upon associated metadata. A comprehensive study established a framework for comparison of descriptive metadata schemata for music player applications, but was not set in the context of sales.[91] These topics have not yet been combined to examine the effect of metadata upon an online music store. Would richer metadata lead to greater digital download sales?

The purpose of the proposed study is to extend previous research by specifically examining the effect upon sales of richer metadata in an online music store interface. By correlating the amount of metadata with user behavior and sales statistics, this study seeks to determine if sales are influenced by the amount of metadata presented to the user. Study setting examples will be named, but this study model is useable by any party interested in performing their own tests. It is strongly suggested that this model for examination be used in multiple settings to increase applicability of results. It is also suggested that all data from this study be released to the public to allow for extended analysis.

Participants

The participants of this study will be anonymous visitors to a web-based music discovery interface that also offers access to purchase downloadable music. An example of this could be the Grammy.com website during a single time period during an upcoming Grammy awards season. Other web-based music stores that could use this study model are Rhapsody, Amazon MP3, CDBaby.com, eMusic.com, and classicalarchives.com.

Data Collection Instrument

The primary data collection instrument will be two versions of a web landing page, which presents links to purchase music tracks. One version of the page would have the standard level of metadata as shown in today's typical online retail environment (i.e. artist, track name, album name, year). The other version would provide richer interconnected metadata such as songwriter, producer, musicians, etc. By comparing the sales statistics generated by the “regular” and “rich” landing pages, quantitative data will show any correlation between richness of metadata and sales figures. These two landing pages would each be served to equal numbers of visitors.

To control for any time-based variables such as particular artists’ tours or media appearances, the two participant groups would be selected from visitors during the same time period. During the specified time period, alternating visitors to the landing page would be unknowingly served one of the two versions of the page dynamically. For example, evennumbered visitors would go to the simple page, and odd-numbered visitors would be sent to the rich page.

This splitting of visitors would be possible by means of web server caching and load-balancing systems. High-volume websites employ various methods to handle spikes in visitor traffic. For example, during each year's Grammy awards, Grammy.com uses extensive memory caching, Varnish caching, and the Drupal content management system to handle huge spikes in traffic, reported to be 31 million page views during the 2011 awards show weekend.[92] In 2010, there were 3.8 million unique visitors to the website over the three-day awards show period.[93] An enterprise-level system such as this could allow for precise control of multiple streams of traffic. Other music services see associated spikes in traffic and sales at this time each year.

Procedure

This study would require approval from the site's current development team and management. The two landing pages would be developed by the development team, in consultation with researchers. Tests would be run ahead of time to ensure that the two pages were complete and did not contain any broken links.

The pages and server configuration would be built during an initial design phase. In the example of Grammy.com, this would take place before the nominees are announced in early November, and the Grammy nominees' metadata would be entered immediately after the announcements.

Visitor data collected will remain anonymous. Visitors will be given unique identifiers consisting of the initial visit timestamp plus a sequential number. Statistics gathered will include: visitor time spent on landing page, visitor click-through rate to music retailer, visitor purchase quantity (singles), visitor purchase quantity (albums), and visitor purchase dollar amount.

The source of the descriptive metadata needed for the landing pages is an important consideration. The metadata would be manually entered from multiple silos of information, such as allmusic.com, MusicBrainz, and Discogs. As part of the research report, general comments would be noted regarding the success of finding needed information from each silo. Alternatively, an API feed from one silo could help streamline the process.

The timetable for this study would be six months: one month to plan, three months to implement, and two months to analyze and report.

Statistical analysis will test for correlation between landing page group (regular or rich) and the following variables: visitor purchase quantity (singles), visitor purchase quantity (albums), and visitor purchase dollar amount. These correlations will test the hypothesis that richer metadata results in greater sales.

This study will take funding in order to happen. It will require paid personnel to get the coding done, enter metadata and administer servers. Once the data is gathered, further research is less of a financial hurdle. Funding could come from a grant or a donation. In order to maintain independence, it might be appropriate to donate all profits from music sales to a charity such as music education.

A potential problem with this study is the sample population. The visitors during the test period may not adequately represent the music-buying public at large. Demographics could be gathered from web servers to ascertain the makeup of the website visitors during the test period.

At the end of the study, releasing the raw data for further analysis would be an inexpensive way to achieve extended analysis.

Conclusion And Recommendations

There is a clear path to repair the music industry's descriptive metadata problem, with two components: standardizing a schema for descriptive metadata, and achieving a globally unique abstracted persistent identifier. While previous discussions have been based on the assumptive goal of a central authority for descriptive metadata, a more pertinent goal is a standardized schema. The necessary components of this solution are:

1. Rallying the political will to agree that a common solution is in the best interest of the industry.
2. Standardizing a descriptive metadata schema.
3. Implementing a coordinated standard representing a globally unique abstracted persistent identifier (GUAPI).

The first component is a business decision, not a technical challenge. Anyone who has encountered the "metadata problem" knows that this is significant. Those who have dug deeper know that it is very complex and political. Competitors must come together as they did to build DDEX, and work toward a common good.

If the proposed "Quantifying Descriptive Metadata Value" study or similar analysis proves that richer metadata leads to greater sales, stakeholders will be inclined to implement richer metadata in their digital downloads and streaming services. By quantifying the value of richer metadata in concrete sales terms, decisions can be made based upon statistics rather than speculation. Armed with this knowledge, stakeholders could get behind the need for change. Up to this point, the political will did not exist.

The second component is to develop a schema for descriptive metadata though a standards organization such as DDEX or ISO. The two strongest candidates for this are

MusicBrainz and CCD. CCD is designed to document the production of a recording as it is created, but does not concern itself with the recording after it is released. For example, CCD does not describe the complex relationship of multiple releases of the same title, or consumer media formats. On the other hand, MusicBrainz is designed to describe a recording that has already been released. MusicBrainz does not offer the capability to describe a project in progress, nor can it keep a release's metadata private until the release date (a functional requirement). Both CCD and MusicBrainz are missing essential stages of the lifespan of a recording.

Therefore, it would require a combination of the approaches of the two schemata to provide a comprehensive description of all aspects of a recording. Perhaps these approaches could be merged to use the best aspects of each. CCD has been designed with standardization in mind, and is now held by DDEX. The MusicBrainz schema is road tested, is fully implemented now, is fully abstracted, is independent, and can accommodate semantic data. Combining the strength of CCD with the abstracted vision of MusicBrainz makes sense.

For those that remain skeptical of the quality of the contents of the MusicBrainz database, remember that the schema is separate. What is being advocated here is the strength of the structure of MusicBrainz, not the content. The current contents of MusicBrainz could be considered as one big test sample, which has already proven the approach to be viable. There is no denying the comprehensiveness of the schema.

No single current approach solves the metadata problem. What is needed is a more coordinated environment so that aspects of each service can be used in concert, rather than in competition. A standardized schema would create this coordination, and each intellectual property stakeholder could evaluate the market of metadata solutions and decide which works best for their needs. Some workflows may require a proprietary silo due to mission–critical business needs. Others may opt for an open system. Some may need deep data, while others may just need a flat model. Perhaps this environment could even spur development of a central authority.

The other keystone component is to achieve a “Globally Unique Abstracted Persistent Identifier,” or GUAPI. There are two routes to this. ISRC, ISWC, and GRid could merge their governance and set goals toward a coordinated PID. This would clearly be a more difficult political process than the creation of one new standardized schema. If this PID merger proves impossible, proceedings should begin immediately to standardize a new GUAPI. This would take many years so the time to start is now. In short, if the current standards can’t evolve, they should be replaced.

Whichever path results, standardization of a GUAPI would give all interested parties a common data point to build upon, stimulate the marketplace of descriptive metadata solutions, and accelerate technical evolution. It would benefit the entire industry, including record labels, artists, and the metadata silos. Systems such as DDEX, online retailers, music services, and the rights organizations could communicate directly by means of a common, abstracted reference point.

The components outlined above have precedent in <indecs>, the foundation of DDEX. “The <indecs> framework recognizes four guiding principles for the development of ‘well-formed’ metadata to support effective e-commerce.”[19] These principles are: Unique Identification, Functional Granularity, Designated Authority, and Appropriate Access. The components recommended in this report address these principles to achieve an effective solution.

By centralizing and democratizing the industry’s descriptive metadata schema and identification system, digital downloads would be more easily enriched with metadata. Benefits would flow to all parts of the ecosystem, including business, technical, creative, and consumer. Business would be enhanced through a more powerful platform for innovation and a richer consumer experience. Technical advances would be fostered. The creative community would be properly acknowledged. And consumers would gain a deeper knowledge of the art they are supporting.

Without following this proposed path, the “metadata problem” might only be addressed by more commercial battles, where companies keep reinventing the wheel. Until a common schema and GUAPI are developed, new digital music services will continue to make end-runs around standards. While not “competing” under the same constraints, standards and de facto solutions nevertheless are evolving simultaneously. In this competitive landscape, if the better system is still in committee, then the system that is available now becomes the better system. Instead, collaboration towards a common solution is in every party’s best interest.

If there is anything that music industry professionals can agree upon, it may be that competitors in the industry have not collaborated well. DDEX is a rare example of competitors collaborating to benefit the industry at large. DDEX has also proven to be highly effective, creating significant efficiencies with clear financial advantage. This can serve as an example. Collaboration to create standards is worth the cost and effort.

The industry is at another crossroads, deciding the right path to take. What is in the best interest of all parties? An unnecessarily complex collection of PIDs? Or, a coordinated standard GUAPI? A competitive landscape, where the most profitable silo wins at the expense of the industry? Or a standardized schema for metadata that benefits all parties and allows for competition? The entertainment industry has fallen into this trap before in brutal format wars that alienated customers, selected inferior formats, and left companies reeling. Those who fail to learn from history are doomed to repeat it.

Disruptive solutions can be more successful with the catalyst of political will. Previous attempts at standards have been mired in legacy approaches. If these proposals were to be achieved, support would be needed both from commercial stakeholders and organizations that are independent of business interests. One strong contender to foster progress is The Recording Academy (The National Academy of Recording Arts and Sciences), an organization of musicians and technical workers who vote on the Grammy Awards. Here it is important to note that The Recording Academy is not to be confused with industry trade organizations such as the Recording Industry Association of America (RIAA) and the Music Business Association (formerly NARM, the National Association of Recording Merchandisers). Recently The Academy has promoted the "Give Fans The Credit" initiative to measure public desire for richer metadata and campaign for its inclusion.[28] This initiative successfully prompted the online streaming service Rhapsody to offer digital liner notes.[94,95]

MusicBrainz is known for their stalwart independence. If MusicBrainz is to be a source of a standardized schema, they may need a companion organization to advocate for them within the music industry. If The Recording Academy could advocate on behalf of the MusicBrainz schema, it would further the two organizations' common cause of proper crediting for musicians and technical workers. The Academy is in a unique position to represent this issue in the industry. The easiest method to familiarize Academy members with MusicBrainz is by showing them how to enter credits. Who better to enter credits than the people directly involved? Perhaps an arrangement could be made like the one made with the BBC, whereby the Academy could offer specialist editors and resources to MusicBrainz in exchange for a data feed for grammy.com.[66] The bully pulpit of the Grammy Awards gives The Recording Academy the influence to bring stakeholders to the table. The Recording Academy has the motive, means, and expertise to initiate change. And both organizations could improve their public image by this collaboration.

More generally technical workers in the music industry must prioritize metadata stewardship throughout all stages of production. From the earliest stages of recording to later distribution, metadata must be passed along using common standards. Artists must demand it in their contracts. Software developers must prioritize the inclusion of metadata throughout the production chain. Developers and end users should choose standards that adhere to good practices such as abstracted models and open interchange. It would also be very valuable to develop crosswalks to translate common elements between different metadata schema such as CCD, MusicBrainz, and proprietary APIs.

The “metadata problem” is clearly not easy to solve. What appears on the surface to be a technical hurdle is in actuality a very complex quagmire of business obstacles. If the above recommendations are not sufficient, then our attention should turn to the reasons why. Is the current system too entrenched to evolve? Is it too convoluted to be understood? If so, then the music industry could face serious long-term problems well beyond proper crediting of artists. It could face worse public relations issues than the popular but simplistic image of a collapsing, bloated, insular private club. Perhaps it is inflammatory to state, but problems such as this could theoretically snowball and reach a tipping point similar to that faced by the financial sector, whose leveraged debt and derivatives became too complex to understand. The foundation of music must be repaired. Is the music industry too big to fail? Not anymore.

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Appendix: Acronym Reference

Acronym	Expansion	More Information
API	Application Programming Interface	http://en.wikipedia.org/wiki/Application_programming_interface
CCD	Content Creator Data	http://blogs.loc.gov/digitalpreservation/2011/12/content-creator-data-tool-released-by-ndiipp-partner/
DDEX	Digital Data Exchange	http://ddex.net/
EAN	International Article Number, formerly European Article Number	http://en.wikipedia.org/wiki/International_Article_Number_(EAN)
FRBR	Functional Requirements for Bibliographic Records	http://www.loc.gov/catdir/cpso/whatfrbr.html
GRD	Global Repertoire Database	http://www.globalrepertoiredatabase.com/
GRid	Global Release Identifier	http://www.ifpi.org/content/section_resources/grid.html
GUAPI	Globally Unique Abstracted Persistent Identifier	First coined in this report.
indecs	interoperability of data in e-commerce systems	http://en.wikipedia.org/wiki/Indecs_Content_Model
IPI	Interested Parties Information Code	http://en.wikipedia.org/wiki/Interested_Parties_Information
ISBN	International Standard Book Number	http://www.isbn.org/
ISNI	International Standard Name Identifier	http://www.isni.org/
ISRC	International Standard Recording Code	http://wiki.musicbrainz.org/ISRC
ISTC	International Standard Text Code	http://www.istc-international.org/
ISWC	International Standard Musical Work Code	http://www.iswc.org/en/faq.html
LOC	Library of Congress	http://www.loc.gov/about/
MBID	MusicBrainz Identifier	http://wiki.musicbrainz.org/MusicBrainz_Identifier
UPC	Universal Product Code	http://en.wikipedia.org/wiki/Universal_Product_Code