



Audio Engineering Society Convention Paper

Presented at the 115th Convention
2003 October 10–13 New York, New York

This convention paper has been reproduced from the author's advance manuscript, without editing, corrections, or consideration by the Review Board. The AES takes no responsibility for the contents. Additional papers may be obtained by sending request and remittance to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-2520, USA; also see www.aes.org. All rights reserved. Reproduction of this paper, or any portion thereof, is not permitted without direct permission from the Journal of the Audio Engineering Society.

The Requirement for Standards in Metadata Exchange for Networked Audio Environments

Nicolas Sincaglia¹

¹FullAudio, Chicago, IL, 60604, U.S.A

ABSTRACT

In a networked audio environment, metadata not only provides a human interface but is used for the identification, organization, tracking, reporting and selling of digitized sound recordings. Establishing an open industry standard for this data will enable the entire industry to streamline its ability to make content available. The result will be a more efficient and uniform exchange of data, ultimately enabling a more versatile and profitable music industry.

1. INTRODUCTION

At the core of the music industry is the concept of intellectual property. One cannot sell intellectual property. One can only license rights to the limited use of an intellectual property work. When products or services are developed from the use of such intellectual property works, permissions must be granted and royalties paid, to all entitled entities within the music industry chain. The life cycle of a single work of intellectual property can involve composers, performing artists, recording companies, distributors, performance rights organizations, music publishers, music retailers, hardware manufactures and software developers. Each of these entities must interact and exchange information with each other in order for a single work of intellectual property to be

made available for public consumption. This can be a very slow and arduous process as it currently stands today when trying to release products or services using a collection of intellectual property works.

Due to advent of the computer network, entirely new opportunities have become available to the entertainment industry. These new opportunities have come about due to the ease and efficiency in which today's networked computers can copy, store and distribute music files. With these new opportunities, come new challenges. These new challenges stem from the grand scale in which huge volumes of intellectual property now need to be acquired, digitized, licensed, performed and tracked.

Intellectual property has never before been amassed at such scales in purely a digital form.

In a networked computer environment, metadata is required for more than for just a human interface. Metadata is required for the identification, organization, tracking, reporting and selling of digitized sound recordings. Metadata is the only means by which these organizations can identify individual intellectual property works. There is a need for the establishment of a metadata standard that is robust, versatile and addresses the needs of all entities within the music industry chain. The industry is currently being hampered by the lack of a data exchange standard. It is preventing the industry from effectively communicating with each other. In its simplest form, the future music industry will consist of two main business transactions: contracts and data exchange. The industry has just begun to take steps in this direction. If a data exchange standard could be established, the exchange of data between all the entities within in the music industry would become reliable and efficient and would ultimately result in a more profitable music business.

2. THE MUSIC INDUSTRY

To fully understand the difficulties that the music industry is experiencing today, one need to understand, from a high level, what the process has been historically for developing products or services in the music industry before the wide-spread use of the networked computer. In order for one to distribute products or develop services based on intellectual property works, one is required to communicate with various individuals and organizations within the music industry chain.

For one to develop products or services based on a single music composition there is only one license one must acquire for the use of this copyrighted intellectual property work. Sheet music and midi files are examples of products which require only a single license from copyright owners of a music composition. Typically, composers of musical works hire publishing organizations to manage, track and license their musical compositions on their behalf. One must first identify the owners or their publishing organizations which represent the musical works and negotiate a license for its use.

Developing products or services from sound recordings involves typically two licenses before one can legally use the sound recording. When a musical work is captured on a medium, the sound recording itself is considered to be an intellectual property work. This sound recording can be copyrighted and

the use of this particular sound recording requires one to license it from the owner of the work. This sound recording license is in addition to the license described earlier for the use of the musical composition.

In the United States, a statutory rate was established for the performance of sound recordings. This statutory royalty was established to compensate the writers and composers for the public performances of their compositions. These public performances can be live performances or the playing of music compositions that have been captured in sound recordings. A radio broadcast of a recording is an example of a service that can be provided with the use of existing sound recordings and musical compositions which is required to pay performance royalties. A statutory rate was established in the past for these performance royalties instead of a direct license. The contributors on sound recordings typically hire these performing rights organizations to manage, collect royalties and track the performances of their musical works on such music services. The music service provider typically pays this statutory rate to these performing rights organizations, which collect and redistribute these royalties to the composers which they represent.

Once all of the required licenses have been obtained, one can finally develop products and services using these intellectual property works. The sound recordings must next be encoded in a standardized format for the particular medium in which they will be stored or transmitted. The majority of encoding standards in wide-spread use only encode the musical waveforms of the sound recordings. The associated metadata to the sound recording is separate from the formatted sound recording used for storage or broadcast. This metadata information, which is used to identify the sound recording and all the individuals and organizations associated with the copyrights encompassed in the sound recording, is normally transmitted as a separate stream or are embodied in separate "liner notes" to accompany the formatted sound recordings. There has never been a requirement to include this metadata information with these sound recordings. Without any metadata standards, the metadata that does accompany these sound recordings are not reliably consistent or contain any baseline of information.

3. THE NETWORKED MUSIC INDUSTRY

As one can see, the current process to develop products and services in the music industry is an arduous and time consuming process. As a result, releasing products is a slow process, metadata records

are difficult to acquire and maintain and royalties can be difficult to properly distribute to all deserving parties.

The realities of conducting business in the music industry is magnified tenfold when we introduce these new potential business opportunities brought about by the wide-spread use of the computer network. Today, with so many computers networked and communicating with each other, new opportunities arise to offer products and services to everyone who is connected. The ability to make available enormous catalogs of sound recordings to the general public is a true possibility with today's technology. It is conceivable that potentially every composition and recording ever created could one day be made available for access to anyone who is willing to pay a fair market value for it.

These efforts are currently under way by many organizations within the music industry. These organizations have quickly discovered that bringing this dream to fruition is proving more difficult than initially anticipated. The difficulties stem from the slow and arduous process required to identify, contact and negotiate individual licenses for every single piece of intellectual property one intends to use. As described earlier, this information is difficult to obtain. This data is separate from the sound recordings and if there is metadata accompanying the physical products, this information is typically incomplete. In order for organizations to develop these new products and services there needs to be a concerted effort to make it easier to identify intellectual property works, their owners and the organizations which manage, license and collect royalties for the use of these works. A data exchange standard needs be developed which will meet the data requirements of each entity in the industry chain. This data standard would allow every organization within the music industry chain to easily exchange the data required to do business in this new age of connectedness. Figure 1 illustrates the entities within the music business and the flow of data required between each of them. This new connected reality will one day reduce the music business down to two main components; contracts and data exchange. The development of such a standard would allow the industry as a whole to move towards this new reality.

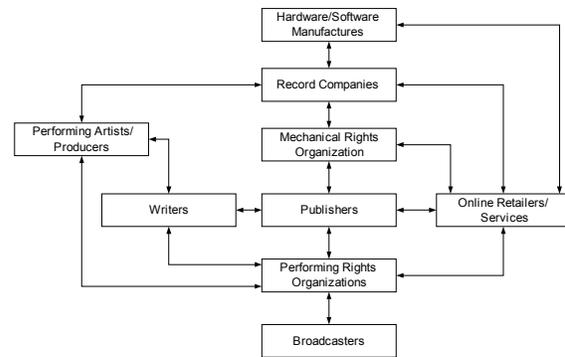


Figure 1.

4. DESIGNING A DATA EXCHANGE STANDARD

In order to properly develop such a standard, one must take the time to analyze the data requirements for each entity within the music industry and become familiar with the accepted business practices before one can properly model the data requirements. Every industry is different. And for those who are familiar with the music industry will recognize that in this is an industry where many times the exception is the rule. A standard for this type of industry needs to be versatile and robust to enable one to still obtain the pertinent information when unique identifiers and control codes are missing from the metadata.

4.1. THE COMPOSITION

Development must begin by creating a baseline of information of which all entities require. It makes sense to begin with the music composition. Without the music composition, the rest of the industry would not exist. All music industry entities will require the data exchange standard to positively identify the copyrighted music composition when communicating with each other.

Every composition contains a title. Titles are not unique identifiers and cannot be relied upon solely to identify the composition. Composers can give their compositions any name they please which can result in completely different works containing the same character sets for identification. One might think to combine the composition title with the composer's name to create a unique key to identify an intellectual property work. Even this is not guaranteed to be unique. There are situations that can arise where a composer creates entirely new compositions from variations of a theme. Each variation is a unique work based on single theme, but can contain same composition title and composer name. In addition, a composer can use the same title for two compositions. It is unusual but there are examples of this in the music world. Composition titles are

assigned by the composer who may be completely unaware of the implications caused in the business world.

There is also the case where a composition does not have an identifiable composer. This would be the case when a composition is considered to be “traditional”. These “traditional” compositions typically have deep seeded cultural, national or religious roots. This type of composition is the type that may have survived the all the tests of time except the identification of the original composer(s).

There is also the issue of derivative works. “A ‘derivative work’ is a work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art production, abridgment, condensation or any other form in which a work may be recast, transformed, or adapted. A work consisting of editorial revisions, annotations, elaborations or other modifications which, as a whole, represents an original work of authorship is a ‘derivative work’” [1]. Copyright law gives the owner of a copyright exclusive right to prepare derivative works based upon the original copyrighted work so it is an important piece of information to capture but can cause difficulties when trying to identify the original composition from its derivatives if the same composer has developed both. In an attempt to identify a derivative work from the original work, one might include the name of the arranger and include a descriptive element by which the derivative may be used to differentiate itself from other original or derivative works. This descriptive element could be a wide range of categories that might include the instrumentation used in the arrangement, the performance for which it was developed, or even a time stamp for its creation.

The publishing industry has certainly been aware of the problem of uniquely identifying music compositions. They have made efforts in the past to create unique identifier codes in order to manage this situation. The coding system is called the International Standard Musical Work Code (ISWC). The premise behind this coding scheme is to assign a unique code to each and every composition that is created and registered. The problem is that anyone in the world can compose a piece of music and only small portion of those people actually complete the process by having an ISWC code assigned. In developing a standard to identify copyrighted music compositions, having an ISWC code allows one to positively identify a single composition. In its absence though, the combined data fields of the

composition title, the composer(s), the arranger(s) and an indication of which derivative arrangement is contained in the work may be the best combination of a unique identifier as is possible in a situation such as this, where the industry has little control over development or naming of the products it builds its business around.

In addition to positively identifying the music composition, the composer(s), arranger(s) and derivation, we will need to provide additional data associated with licensing and royalty payments. “Under the copyright law, ownership of all rights to a song resides initially with the songwriter. However, in order to have a song [commercially] exploited, it is usually necessary for a songwriter to turn ownership of the song over to a publisher” [2]. “The publisher obtains ownership of a copyright through his contract with the songwriter (here, a collective term for composer and lyricist together). The contract provides that the copyright to a song be transferred to the publisher in exchange for a portion of future income” from its commercial exploitation [2]. If a composition has been coauthored some rights may have already been assigned to another firm. The relationship between a single composition and publishing firm may be a one to many relationship and the exchange standard needs to embody this fact in its structure.

“Most publishers rely on a licensing agency to write licenses for [mechanical rights] and to collect the royalties from them” [2]. In the United States, these agencies include the Harry Fox Agency, American Mechanical Rights Association and the Copyright Service Bureau Ltd. There are typically one or two agencies per country that perform these services for publishers in that region of the world. They include JASRAC in Japan, GEMA in Germany, Austria, Bulgaria, Rumania, Israel, Turkey and the Philippines and SDRM in France, Belgium, Holland and Luxembourg to name just a few. Publisher to mechanical royalty collection agency is a one to one relationship.

Figure 2 is an illustration of an embodiment of our data model thus far. Solid lines indicate required data fields. Dotted lines represent optional fields. The model also indicates whether an element is bounded or not. Figure 3 illustrates in more detail the composer element of the composition data structure. The composer element is of type “Entity” and contains another complex type named “ProperName” The two data structures are reused later in our data modeling.

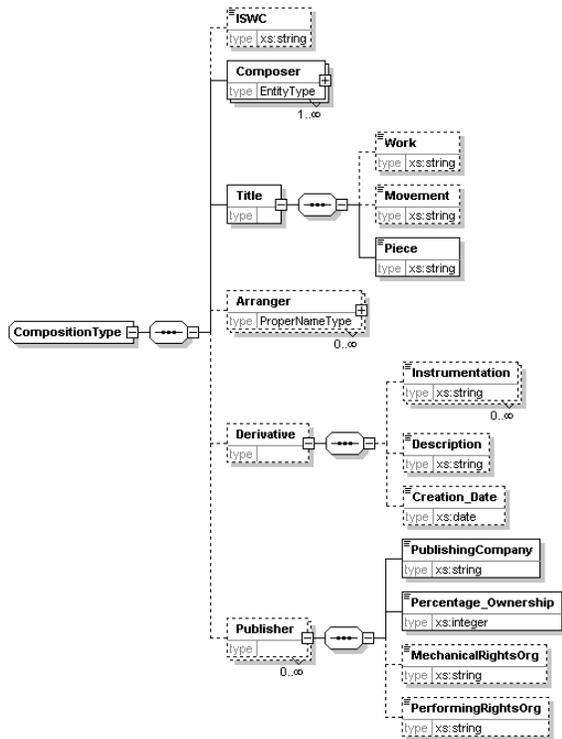


Figure 2.

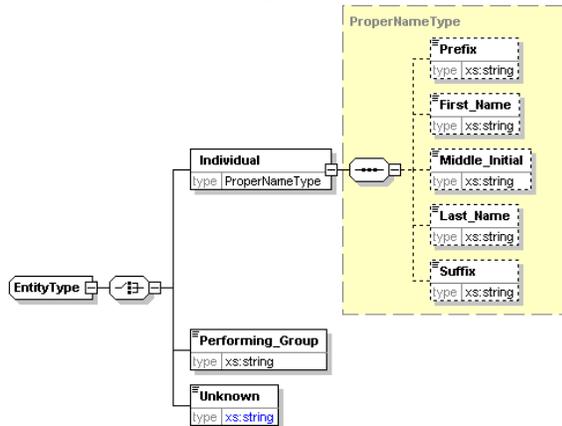


Figure 3.

4.2. THE SOUND RECORDING

“[Copyright law] draws a sharp distinction between the composition or ‘work’ and ‘any material object in which the work is embodied’. Thus the work is an abstract entity in itself, distinct from any printed or recorded representation of it” [2]. Thus far, we have concentrated our efforts on the identification of this “work” and entities that are identified as having contractual rights and obligations to the work. Next, attention must be paid to the embodiment of this work. “There are two types of material objects in which ‘works’ are embodied. In general, *copies* are

objects from which a work can be read or visually perceived, directly or with the aid of a machine or device, such as a manuscripts, a book, sheet music, film, or videotape. *Phonorecords* are objects embodying fixations of sounds, such as audio tapes and phonograph discs. For example, a song (“the work”) can be reproduced in sheet music (“copies”) or on records/tapes/compact discs (“phonorecords”), or all of these” [2]. One must be clear in the distinction between copies and phonorecords from “sound recordings”. “[Sound recordings] are ‘works’, not ‘copies’ or ‘phonorecords’. Sound recordings are works that result from the fixation of a series of musical, spoken, or other sounds. Thus, a ‘sound recording’ is a type of ‘work’ distinct from any reproduction of it on tape or disk” [2]. When developing this portion of the data exchange standard one must understand the distinction between each of these copyright law definitions in order properly model the data associated with an embodiment of a musical “work”.

“As stated above, a sound recording is a type copyrightable work in itself. Although it is normally based on another work, such as a song, under the Copyright Act a sound recording itself is entirely separate from the musical work it represents. The sound recording of a song is a particular performance version of that song and as such is fully protected by the statute. In a sound recording there are two elements deemed to be copyrightable: the contributions of the performer(s) whose performance is captured; and the contribution of the record producer who captures and processes the sounds to make the final recording. Authorship for the sake of copyright is given to either the performer(s) or the record producer or both. Whereas the author of a song generally transfers ownership to a publisher, the author(s) of a sound recording usually transfer ownership to a record company” [2].

Copyright law in the United States and in many other countries around the world, “grant owners the exclusive right of public performance. No one may publicly perform a musical work for profit without obtaining permission from the owner” [2]. The “writers or publishers” of the “work” contained in the sound recording, contract with agencies to manage licensing and royalty collection for the public performance of their “works”. Organizations which license and collect royalties on public performances of a “work” are known as Performing Rights Organizations. The three main organizations in the United States that perform such services include the American Society of Composers, Authors and Publishers (ASCAP), Broadcast Music Inc. (BMI)

and the Society of European Stage Authors and Composers (SESAC). Because a sound recording can have multiple “authors” and/or “publishers” this is a one-to-many relationship between the sound recording and the performing rights organization. Each author and/or publisher can be represented by any performing rights organization to which it has contracted.

Recently there has been an additional performing rights organization created in the United States to manage, license and collect royalties for the owners of sound recording copyrights of public performances of digital transmissions over networks or satellite broadcasts. The organization SoundExchange was developed after the passing of the U.S. Digital Performance Right in Sound Recordings Act in 1995 [6].

Just like musical compositions as discussed before, there can be difficulties identifying a sound recording. The same musical composition can be fixated in any number of sound recordings. Typically, the sound recording is named after the composition that has been fixated. As discussed earlier, composition names are not unique identifiers and the problem is further exasperated by multiple sound recordings by the same performers and producers of that same work. In addition, the same “fixation of a series of musical, spoken or other sounds” [2] can be edited, modified or remixed in any number of ways for a totally new derivative sound recording to be created. Each sound recording tends to be named the same name each time it is recorded. The individuals within industry for the most part, are not aware of the business implications to such practices. This makes it a challenge to uniquely identify the sound recording from other sound recordings by the same performers and producers of the same musical composition. When exchanging data between entities for such sound recording works, it imperative that metadata associated with each sound recording is uniquely identified.

The recording industry has been aware of the difficulties associated with sound recording identification and has made attempts in the past to create a unique coding scheme to uniquely identify each sound recording. The coding scheme is called International Standard Recording Code (ISRC). This coding scheme suffers from much of the same problems that the ISWC coding scheme has and as a result it is not universally adapted by everyone who creates sound recordings. “Although it was adopted by ISO more than 10 years ago, less than 50% of recordings on the market have an embedded code”

[3]. Without strict compliance by all developers of sound recordings a data exchange standard must embody a supplemental mechanism to still uniquely identify a sound recording in the absence of an ISRC code association with a sound recording. This can be done by supplementing the sound recording name with an additional field of data to identify the particular performance of the sound recording. This is usually identified as a “take” in the industry and a sequential number is assigned to each “take”. Time stamps are also good indicators but are rare for performances other than those captured at live events. Other potential indicators can be expressed in a descriptive field that explains the instrumentation, intended purpose or remix variations. In the absence of a ISRC code associated with a sound recording, the combination of the sound recording name, “take”, performer(s), producer(s) and descriptive indicator will in most cases be sufficient to uniquely identify a single sound recording if the owner of the copyright remains consistent in their nomenclature. A data model for the phonorecording data requirements can be seen in Figure 4.

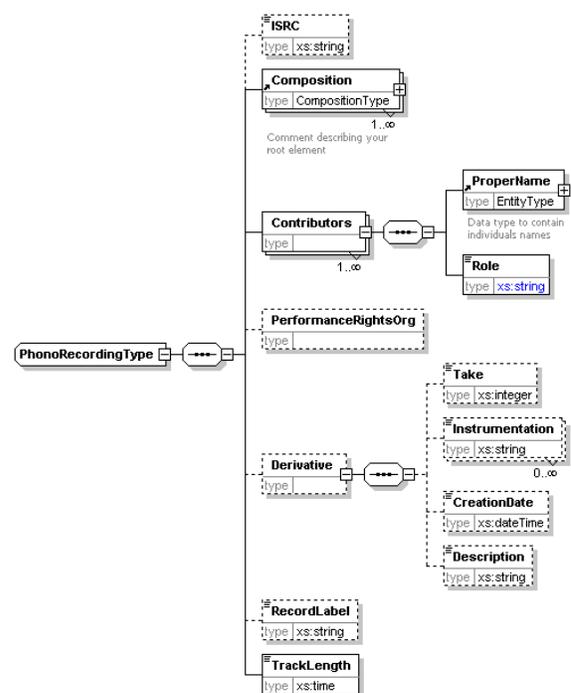


Figure 4.

4.3. THE EMBODIMENT

We have so far identified the data requirements associated with both the music composition as well as the sound recording. As mentioned earlier “there are two types of material objects in which ‘works’ are embodied” [2]; *copies* and *phonorecordings*. Today’s

computer networks allow existing embodiments of works to be digitized and distributed electronically worldwide. Over these networks the embodiments are fixated within digital files or streams. When exchanging digital embodiments, metadata is required to indicate the attributes contained within the encoded file. The recipient of such a digital embodiment will require information about the file itself. Hardware and software devices will also require this information in order to properly render the digital file. For *phonorecordings* this would include the type of encoding used, the sampling rate, bit resolution, bitrate and the number of audio channels required for playback. Lastly the metadata for the file should include the digital file name and file extension. This discussion is limited to *phonorecording* embodiments and the choice has been made not to delve further into the specifics of other types of embodiments which might be considered *copies* in copyright law as identified earlier. Figure 5 shows a block diagram of the embodiment data requirement.

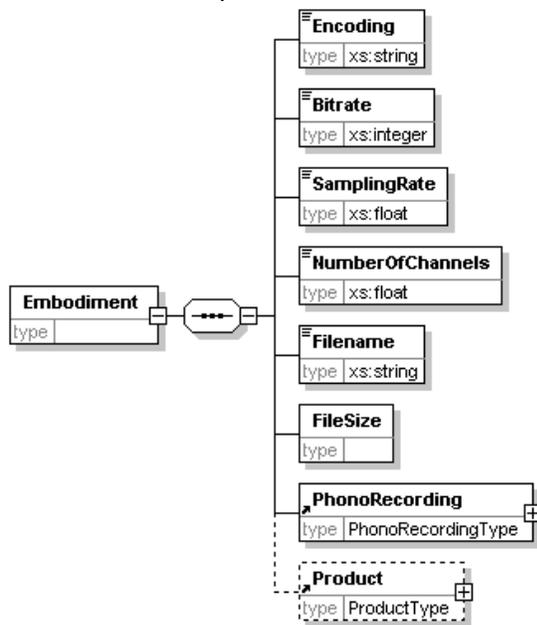


Figure 5.

If the digital file embodiment was created from another existing embodiment, this source embodiment needs to be referenced in the metadata that accompanies the digital embodiment. The source embodiment contains an additional set of data requirements that must be included with its digitized version. These data requirements can include owner or manufacturer of source embodiment, the physical medium from which the digitalize embodiment was created and if the source embodiment was digital or

analog source. If the source embodiment were commercially released the data exchange standard would need to include data about the commercial product. Among these attributes would be the release date, universal product code (UPC) and the title given to the product.

It should be mentioned that source embodiment of a work may have value adding packaging that accompany a phonorecording embodiment. This packaging might include images and text which should continue to accompany the digitized embodiment. These text and image data would need to be included in the data exchange with additional digitized files and metadata that contain information about the encoding used, bit resolution, image diameter, character set standard used, filename and file extension.

Figures 6 and 7 are block diagram representations of these data requirements discuss.

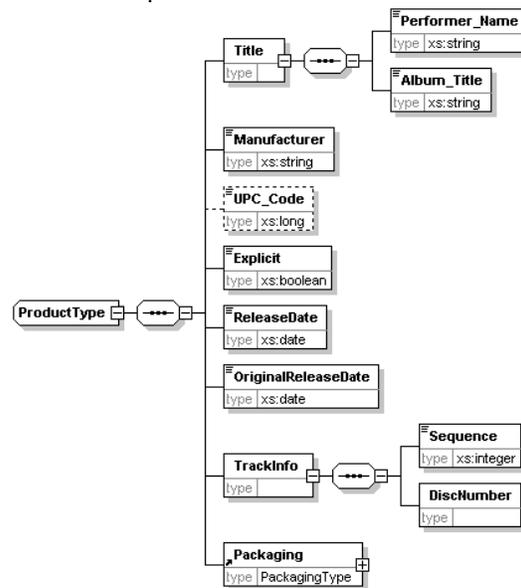


Figure 6.

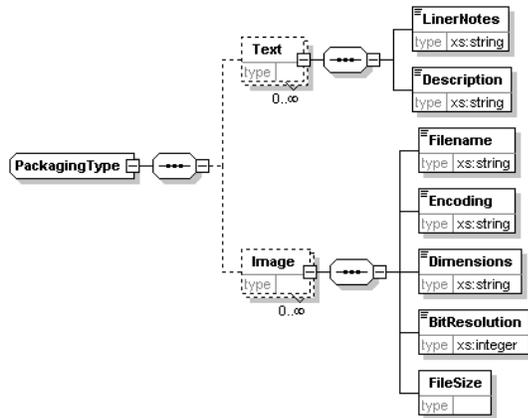


Figure 7.

5. IMPLEMENTATING A DATA EXCHANGE STANDARD

One can implement a process to exchange data any number of ways. The sender and receiver must both agree on a method in which the data will be transmitted and received. Then the process needs to be built according to their specification. In developing a data exchange standard for an industry as complex as the music industry, it is advantageous to begin by choosing an open technology standard. One that is free and clear of any intellectual property restrictions such as patents, trademarks, copyright or trade secrets. XML is just such a standard. At its simplest terms, “XML is a set of standards to exchange and publish information in a structured manner” [4]. XML is short for Extensible Markup Language created by the W3C. “Areas where XML will be useful in the near term include exchange of information between organizations” [4] “The promise of XML is that it’s an easy way for different applications to talk to each other. If an application can parse, or understand XML, then it can send or receive any kind of information to any other application that understands XML” [5]. This is precisely the type of technology required from which to implement a data exchange standard.

When creating a custom markup language, one must also develop a way to let the receiver of this information know its structure. Communicating the structure of the custom markup language, acts as a sort of dictionary for those on the receiving end of the data exchange. There are two main ways that one can provide this information today using XML. They include a Document Type Definition (DTD) or an XML Schema. “It is important to understand that DTDs and XML Schemas ultimately serve the same objective. Both let you describe the structure of XML documents. Both are used to validate documents against their models” [4]. “Using an XML Schema

has several advantages over a DTD, as it allows you to more exactly define what kind of data can be in your XML document” [5]. “XML Schema is a language created by the W3C to address some of the limitations of DTDs” [5]. “DTDs were designed for publishing. They are ill-suited to more recent applications of XML, in particular, data exchange and application integration” [4].

Listing 1 is an XML Schema of our data model. It embodies all of the data requirements discussed thus far. It is designed to provide each entity within the music industry chain, a common baseline of information when communicating with each other about the many pieces of intellectual property that make up their businesses. The author refers to this preliminarily as the “Music Industry Data Exchange” (MIDX) data model. This design is not in anyway intended as a final design. It is intended to be only a starting point for further development by those within the industry willing to participate in its development. It should also be noted that development of such a standard is best to be developed as an open standard. Open development can sometimes be the only way to progress in an industry where collaboration is not encouraged due to the competitive nature of the industry as well as governmental concerns of anti-trust and anti-competitive behaviors.

It is best to think of this as perhaps the first version of a single small module of a much more comprehensive data model. “Large modules are expensive to build and difficult to use. A new approach is to break large models into a set of smaller modules and to design these modules so that they can be combined at will” [4]. A data exchange standard for an entire industry can only be developed by those in that industry that understand the needs of the industry and are familiar with the standard business practices. As this new music business matures, old versions will be upgraded and new modules developed to integrate into a larger and more complex overall model.

Listing 2 and 3 are both examples of data documents using the XML Schema contained in Listing 1. In particular, Listing 2 is used to demonstrate how this XML structure accommodates, what is considered to be a fairly typical example of metadata contained in the majority of commercially available sound recording products. The metadata captured in the XML document in Listing 2 is one track on an actual commercially released music CD box set. The track contains just one composition being performed by a small ensemble group.

Listing 3 is used to demonstrate a less typical and more extreme example of metadata in which our XML Schema is required to properly handle. The metadata in Listing 3 describes a live performance by variety of “All-Star” performers that are not considered a group. The metadata shows that this sound recording is an all digital release, meaning there is no commercially available physical product embodiment of the sound recording. The sound recording contains four compositions performed as a medley. Each composition has different composers, arrangers, publishing companies and performing rights organizations. This example is included to put the XML Schema design to the test and demonstrate that its structure is robust and versatile enough to communicate the baseline of information required of it.

Over time, the recording industry must change the way it thinks about the products it sells. In an all digital paradigm, one will need to more closely associate these less tangible products with the intellectual property works that are fixated in the digital files. Most XML Schemas in use today within the music industry do not do this. They are typically based on the physical products used for distribution. The XML Schema in Listing 1 addresses these new needs and was designed specifically for this new change in thinking.

6. CONCLUSION

Today the music industry has begun to change. It is not the first time that technology has impacted the operation of this industry. Historically, this happens roughly every 10 to 15 years. In recent years the speed at which technology advances are being developed seems to have increased at an exponential rate. The computer network, just like the many other technological advances before it, will forever change the way the music industry conducts business.

The primary benefit that the computer network provides is the speed and ease by which separate parties can communicate. The promise of a more efficient and profitable music industry is within reach. Currently however, the parties within the music industry are not speaking the same language. Such a data exchange standard is the most effective way to address this problem. The importance of such a standard goes beyond just improving the ease and efficiency of existing industry communication but provides to those who have yet to participate in this new business environment, a means to quickly and easily join today’s new and all digital market place.

7. ACKNOWLEDGEMENT

I would like to thank my wife Brenda Sincaglia for all the support and encouragement, as always.

Thank you, John Guertin for providing the answers to all my questions regarding copyright law, music licensing and standard music industry business practices.

8. REFERENCES

[1] Baskerville, D. (1990). Music business handbook & career guide (5th Ed.). Los Angeles, CA: Sherwood Publishing Company. Pg. 80

[2] Fink, M. (1989). Inside the music business, music in contemporary life. New York, NY: Schirmer Books. pp. 33-37, 40, 44-49

[3] “Annex I Current Efforts Concerning the Identification of works protected by Copyright and Neighboring Rights,” Electronic Commerce and Copyright: A Key Role for WIPO. http://www.wipo.org/eng/meetings/1999/acmc/2_1-02.htm.

[4] Benoît Marchal, (2002). XML by Example (2nd Edition). Indianapolis, ID: QUE. pp. 7, 42, 90

[5] Dan Livingston, (2002). XML For Web Professionals. Upper Saddle River, NJ: Prentice Hall. pp. 3, 45

[6]. JoJo Gould (February 14, 2002) (John Simson: Executive Director at US collection body, SoundExchange. Music Business Journal. <http://www.musicjournal.org/02johnsimson.htm>

9. LISTING 1

```

<?xml version="1.0" encoding="ISO8859-1"?>
<xs:schema targetNamespace="http://www.mixxml.org/namespace" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns="http://www.mixxml.org/namespace" elementFormDefault="qualified" attributeFormDefault="unqualified">
  <xs:element name="Composition" type="CompositionType">
    <xs:annotation>
      <xs:documentation>Comment describing your root element</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:complexType name="CompositionType">
    <xs:sequence>
      <xs:element name="ISWC" type="xs:string" minOccurs="0"/>
      <xs:element name="Composer" type="EntityType" maxOccurs="unbounded"/>
      <xs:element name="Title">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="Work" type="xs:string" minOccurs="0"/>
            <xs:element name="Movement" type="xs:string" minOccurs="0"/>
            <xs:element name="Piece" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="Arranger" type="ProperNameType" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="Derivative" minOccurs="0">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="Instrumentation" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
            <xs:element name="Description" type="xs:string" minOccurs="0"/>
            <xs:element name="Creation_Date" type="xs:date" minOccurs="0"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="Publisher" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="PublishingCompany" type="xs:string"/>
            <xs:element name="Percentage_Ownership" type="xs:integer"/>
            <xs:element name="MechanicalRightsOrg" type="xs:string" minOccurs="0"/>
            <xs:element name="PerformingRightsOrg" type="xs:string" minOccurs="0"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
  <xs:element name="ProperName" type="EntityType">
    <xs:annotation>
      <xs:documentation>Data type to contain individuals names</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:complexType name="ProperNameType">
    <xs:sequence>
      <xs:element name="Prefix" type="xs:string" minOccurs="0"/>
      <xs:element name="First_Name" type="xs:string" minOccurs="0"/>
      <xs:element name="Middle_Initial" type="xs:string" minOccurs="0"/>
      <xs:element name="Last_Name" type="xs:string" minOccurs="0"/>
      <xs:element name="Suffix" type="xs:string" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
  <xs:element name="PhonoRecording" type="PhonoRecordingType"/>
  <xs:complexType name="PhonoRecordingType">
    <xs:sequence>
      <xs:element name="ISRC" type="xs:string" minOccurs="0"/>
      <xs:element ref="Composition" maxOccurs="unbounded"/>
      <xs:element name="Contributors" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

```

```

<xs:complexType>
  <xs:sequence>
    <xs:element ref="ProperName"/>
    <xs:element name="Role">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="Primary Artist"/>
          <xs:enumeration value="Guest Artist"/>
          <xs:enumeration value="Ensemble"/>
          <xs:enumeration value="Conductor"/>
          <xs:enumeration value="Producer"/>
          <xs:enumeration value="Soloist"/>
          <xs:enumeration value="Narrator"/>
          <xs:enumeration value="Announcer"/>
          <xs:enumeration value="Master of Cerimonies"/>
          <xs:enumeration value="Performing Group"/>
          <xs:enumeration value="Performing Group Musician"/>
        </xs:restriction>
      </xs:simpleType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="PerformanceRightsOrg" minOccurs="0"/>
<xs:element name="Derivative" minOccurs="0">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="Take" type="xs:integer" minOccurs="0"/>
      <xs:element name="Instrumentation" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="CreationDate" type="xs:dateTime" minOccurs="0"/>
      <xs:element name="Description" type="xs:string" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="RecordLabel" type="xs:string" minOccurs="0"/>
<xs:element name="TrackLength" type="xs:time"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="Embodiment">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="Encoding" type="xs:string"/>
      <xs:element name="Bitrate" type="xs:integer"/>
      <xs:element name="SamplingRate" type="xs:float"/>
      <xs:element name="NumberOfChannels" type="xs:float"/>
      <xs:element name="Filename" type="xs:string"/>
      <xs:element name="FileSize"/>
      <xs:element ref="PhonoRecording"/>
      <xs:element ref="Product" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="Product" type="ProductType"/>
<xs:element name="Packaging" type="PackagingType"/>
<xs:complexType name="ProductType">
  <xs:sequence>
    <xs:element name="Title">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="Performer_Name" type="xs:string"/>
          <xs:element name="Album_Title" type="xs:string"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="Manufacturer" type="xs:string"/>
    <xs:element name="UPC_Code" type="xs:long" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>

```

```

<xs:element name="Explicit" type="xs:boolean"/>
<xs:element name="ReleaseDate" type="xs:date"/>
<xs:element name="OriginalReleaseDate" type="xs:date"/>
<xs:element name="TrackInfo">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="Sequence" type="xs:integer"/>
      <xs:element name="DiscNumber"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element ref="Packaging"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="PackagingType">
  <xs:sequence>
    <xs:element name="Text" minOccurs="0" maxOccurs="unbounded">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="LinerNotes" type="xs:string"/>
          <xs:element name="Description" type="xs:string"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="Image" minOccurs="0" maxOccurs="unbounded">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="Filename" type="xs:string"/>
          <xs:element name="Encoding" type="xs:string"/>
          <xs:element name="Dimensions" type="xs:string"/>
          <xs:element name="BitResolution" type="xs:integer"/>
          <xs:element name="FileSize" type="xs:integer"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
<xs:element name="Entity" type="EntityType"/>
<xs:complexType name="EntityType">
  <xs:choice>
    <xs:element name="Individual" type="ProperNameType"/>
    <xs:element name="Performing_Group" type="xs:string"/>
    <xs:element name="Unknown" default="Unknown">
      <xs:simpleType>
        <xs:restriction base="xs:string"/>
      </xs:simpleType>
    </xs:element>
  </xs:choice>
</xs:complexType>
</xs:schema>

```

10. LISTING 2

```

<?xml version="1.0" encoding="ISO8859-1"?>
<Embodiment xmlns="http://www.mixxml.org/namespace" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.mixxml.org/namespace
C:\PROGRA~1\Altova\xmlspy\Schemas\schemata\MusicExchange.xsd">
  <Encoding>AAC</Encoding>
  <Bitrate>96</Bitrate>
  <SamplingRate>44100</SamplingRate>
  <NumberOfChannels>2</NumberOfChannels>
  <Filename>e4820414g2p_1_20_441_96_2.aac</Filename>
  <FileSize>3774302</FileSize>
  <PhonoRecording>
    <ISRC>USRC19900463</ISRC>
    <Composition>
      <Composer>

```

```

    <Individual>
      <First_Name>Jerry</First_Name>
      <Last_Name>Leiber</Last_Name>
    </Individual>
  </Composer>
  <Composer>
    <Individual>
      <First_Name>Mike</First_Name>
      <Last_Name>Stoller</Last_Name>
    </Individual>
  </Composer>
  <Title>
    <Piece>Jailhouse Rock</Piece>
  </Title>
  <Derivative>
    <Instrumentation>Electric Guitar</Instrumentation>
    <Instrumentation>Acoustic Guitar</Instrumentation>
    <Instrumentation>Bass</Instrumentation>
    <Instrumentation>Drums</Instrumentation>
    <Instrumentation>Piano</Instrumentation>
    <Description>Elvis Recording</Description>
    <Creation_Date>1957-04-30</Creation_Date>
  </Derivative>
  <Publisher>
    <PublishingCompany>Jerry Leiber Music</PublishingCompany>
    <Percentage_Ownership>50</Percentage_Ownership>
    <MechanicalRightsOrg>Harry Fox Agency</MechanicalRightsOrg>
    <PerformingRightsOrg>ASCAP</PerformingRightsOrg>
  </Publisher>
  <Publisher>
    <PublishingCompany>Mike Stoller Music</PublishingCompany>
    <Percentage_Ownership>50</Percentage_Ownership>
    <MechanicalRightsOrg>Harry Fox Agency</MechanicalRightsOrg>
    <PerformingRightsOrg>ASCAP</PerformingRightsOrg>
  </Publisher>
</Composition>
<Contributors>
  <ProperName>
    <Individual>
      <First_Name>Jerry</First_Name>
      <Last_Name>Leiber</Last_Name>
    </Individual>
  </ProperName>
  <Role>Producer</Role>
</Contributors>
<Contributors>
  <ProperName>
    <Individual>
      <First_Name>Mike</First_Name>
      <Last_Name>Stoller</Last_Name>
    </Individual>
  </ProperName>
  <Role>Producer</Role>
</Contributors>
<Contributors>
  <ProperName>
    <Individual>
      <First_Name>Scotty</First_Name>
      <Last_Name>Moore</Last_Name>
    </Individual>
  </ProperName>
  <Role>Performing Group Musician</Role>
</Contributors>
<Contributors>
  <ProperName>
    <Individual>

```

```

        <First_Name>Elvis</First_Name>
        <Last_Name>Presley</Last_Name>
    </Individual>
</ProperName>
<Role>Primary Artist</Role>
</Contributors>
<Contributors>
    <ProperName>
        <Individual>
            <First_Name>Bill</First_Name>
            <Last_Name>Black</Last_Name>
        </Individual>
    </ProperName>
    <Role>Performing Group Musician</Role>
</Contributors>
<Contributors>
    <ProperName>
        <Individual>
            <First_Name>D.</First_Name>
            <Middle_Initial>J.</Middle_Initial>
            <Last_Name>Fontana</Last_Name>
        </Individual>
    </ProperName>
    <Role>Performing Group Musician</Role>
</Contributors>
<Contributors>
    <ProperName>
        <Individual>
            <First_Name>Dudley</First_Name>
            <Last_Name>Brooks</Last_Name>
        </Individual>
    </ProperName>
    <Role>Performing Group Musician</Role>
</Contributors>
<PerformanceRightsOrg>SoundExchange</PerformanceRightsOrg>
<RecordLabel>RCA Records</RecordLabel>
<TrackLength>1:55</TrackLength>
</PhonoRecording>
<Product>
    <Title>
        <Performer_Name>Elvis Presley</Performer_Name>
        <Album_Title>Artist Of The Century</Album_Title>
    </Title>
    <Manufacturer>BMG Entertainment</Manufacturer>
    <Explicit>>false</Explicit>
    <ReleaseDate>1999-07-13</ReleaseDate>
    <OriginalReleaseDate>1999-07-13</OriginalReleaseDate>
    <TrackInfo>
        <Sequence>20</Sequence>
        <DiscNumber>1</DiscNumber>
    </TrackInfo>
    <Packaging>
        <Text>
            <LinerNotes>When Jerry Leiber and Mike Stoller wrote the title song to Elvis' third movie,.....</LinerNotes>
            <Description>Track Paragraph</Description>
        </Text>
        <Image>
            <Filename>e4820414g2p.jpg</Filename>
            <Encoding>JPEG</Encoding>
            <Dimensions>200X100</Dimensions>
            <BitResolution>72</BitResolution>
            <FileSize>6052</FileSize>
        </Image>
    </Packaging>
</Product>
</Embodiment>

```

11. LISTING 3

```

<?xml version="1.0" encoding="ISO8859-1"?>
<Embodiment xmlns="http://www.mixxml.org/namespace" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.mixxml.org/namespace
C:\PROGRA~1\Altova\xmlspy\Schemas\schemas\MusicExchange.xsd">
  <Encoding>AAC</Encoding>
  <Bitrate>96</Bitrate>
  <SamplingRate>44100</SamplingRate>
  <NumberOfChannels>5.1</NumberOfChannels>
  <Filename>e4820414g2d_441_96_5_1.aac</Filename>
  <FileSize>10539369</FileSize>
  <PhonoRecording>
    <Composition>
      <Composer>
        <Unknown/>
      </Composer>
      <Title>
        <Piece>Green Sleeves</Piece>
      </Title>
      <Arranger>
        <First_Name>Yngwie</First_Name>
        <Last_Name>Malmsteen</Last_Name>
      </Arranger>
      <Arranger>
        <First_Name>Leonard</First_Name>
        <Last_Name>Bernstein</Last_Name>
      </Arranger>
      <Derivative>
        <Instrumentation>Electric Guitar</Instrumentation>
        <Instrumentation>Symphony</Instrumentation>
        <Instrumentation>Bass</Instrumentation>
        <Instrumentation>Drums</Instrumentation>
        <Instrumentation>Piano</Instrumentation>
        <Instrumentation>Phonographs</Instrumentation>
        <Description>Special medely arrangement for the 115th AES Convention All Star closing performance</Description>
        <Creation_Date>2003-10-13</Creation_Date>
      </Derivative>
    </Composition>
    <Composition>
      <Composer>
        <Individual>
          <First_Name>Carl</First_Name>
          <Last_Name>Perkins</Last_Name>
        </Individual>
      </Composer>
      <Title>
        <Piece>Blue Suede Shoes</Piece>
      </Title>
      <Arranger>
        <First_Name>Leonard</First_Name>
        <Last_Name>Bernstein</Last_Name>
        <Suffix/>
      </Arranger>
      <Arranger>
        <First_Name>Harry</First_Name>
        <Last_Name>Connick</Last_Name>
        <Suffix>Jr.</Suffix>
      </Arranger>
      <Arranger>
        <Prefix>DJ</Prefix>
        <First_Name>Babu</First_Name>
      </Arranger>
      <Derivative>
        <Instrumentation>Electric Guitar</Instrumentation>
        <Instrumentation>Symphony</Instrumentation>

```

```

    <Instrumentation>Bass</Instrumentation>
    <Instrumentation>Drums</Instrumentation>
    <Instrumentation>Piano</Instrumentation>
    <Instrumentation>Phonographs</Instrumentation>
    <Description>Special medely arrangement for the 115th AES Convention All Star closing performance</Description>
    <Creation_Date>2003-10-13</Creation_Date>
  </Derivative>
  <Publisher>
    <PublishingCompany>Wren Music Co OBO Carl Perkins Music</PublishingCompany>
    <Percentage_Ownership>100</Percentage_Ownership>
    <MechanicalRightsOrg>Harry Fox Agency</MechanicalRightsOrg>
    <PerformingRightsOrg>BMI</PerformingRightsOrg>
  </Publisher>
</Composition>
<Composition>
  <Composer>
    <Individual>
      <First_Name>Arcangelo</First_Name>
      <Last_Name>Corelli</Last_Name>
    </Individual>
  </Composer>
  <Title>
    <Work>Sonata da camera in D Minor</Work>
    <Movement>Giga</Movement>
    <Piece>Allegro </Piece>
  </Title>
  <Arranger>
    <First_Name>Leonard</First_Name>
    <Last_Name>Bernstein</Last_Name>
  </Arranger>
  <Arranger>
    <First_Name>Yngwie</First_Name>
    <Last_Name>Malmsteen</Last_Name>
  </Arranger>
  <Derivative>
    <Instrumentation>Electric Guitar</Instrumentation>
    <Instrumentation>Symphony</Instrumentation>
    <Instrumentation>Bass</Instrumentation>
    <Instrumentation>Drums</Instrumentation>
    <Instrumentation>Piano</Instrumentation>
    <Instrumentation>Phonographs</Instrumentation>
    <Description>Special medely arrangement for the 115th AES Convention All Star closing performance</Description>
    <Creation_Date>2003-10-13</Creation_Date>
  </Derivative>
</Composition>
<Composition>
  <Composer>
    <Individual>
      <First_Name>Kal</First_Name>
      <Last_Name>Mann</Last_Name>
    </Individual>
  </Composer>
  <Composer>
    <Individual>
      <First_Name>Bernie</First_Name>
      <Last_Name>Lowe</Last_Name>
    </Individual>
  </Composer>
  <Title>
    <Piece>(Let Me Be Your) Teddy Bear</Piece>
  </Title>
  <Arranger>
    <First_Name>Leonard</First_Name>
    <Last_Name>Bernstein</Last_Name>
  </Arranger>
  <Arranger>

```

```

    <Prefix>DJ</Prefix>
    <First_Name>Babu</First_Name>
  </Arranger>
  <Derivative>
    <Instrumentation>Electric Guitar</Instrumentation>
    <Instrumentation>Symphony</Instrumentation>
    <Instrumentation>Bass</Instrumentation>
    <Instrumentation>Drums</Instrumentation>
    <Instrumentation>Piano</Instrumentation>
    <Instrumentation>Phonographs</Instrumentation>
    <Description>Special medely arrangement for the 115th AES Convention All Star closing performance</Description>
    <Creation_Date>2003-10-13</Creation_Date>
  </Derivative>
  <Publisher>
    <PublishingCompany>Chrysalis Standards Inc OBO Gladys Music</PublishingCompany>
    <Percentage_Ownership>75</Percentage_Ownership>
    <MechanicalRightsOrg>Harry Fox Agency</MechanicalRightsOrg>
    <PerformingRightsOrg>ASCAP</PerformingRightsOrg>
  </Publisher>
  <Publisher>
    <PublishingCompany>Cherry Lane Music Co. OBO Gladys Music</PublishingCompany>
    <Percentage_Ownership>25</Percentage_Ownership>
    <MechanicalRightsOrg>Harry Fox Agency</MechanicalRightsOrg>
    <PerformingRightsOrg>ASCAP</PerformingRightsOrg>
  </Publisher>
</Composition>
<Contributors>
  <ProperName>
    <Individual>
      <First_Name>Yngwie</First_Name>
      <Last_Name>Malmsteen</Last_Name>
    </Individual>
  </ProperName>
  <Role>Soloist</Role>
</Contributors>
<Contributors>
  <ProperName>
    <Individual>
      <First_Name>Leonard</First_Name>
      <Last_Name>Bernstein</Last_Name>
    </Individual>
  </ProperName>
  <Role>Conductor</Role>
</Contributors>
<Contributors>
  <ProperName>
    <Performing_Group>New York Philharmonic</Performing_Group>
  </ProperName>
  <Role>Ensemble</Role>
</Contributors>
<Contributors>
  <ProperName>
    <Individual>
      <First_Name>Harry</First_Name>
      <Last_Name>Connick</Last_Name>
      <Suffix>Jr.</Suffix>
    </Individual>
  </ProperName>
  <Role>Primary Artist</Role>
</Contributors>
<Contributors>
  <ProperName>
    <Individual>
      <Prefix>DJ</Prefix>
      <Last_Name>Babu</Last_Name>
    </Individual>

```

```
</ProperName>
  <Role>Guest Artist</Role>
</Contributors>
<PerformanceRightsOrg>SoundExchange</PerformanceRightsOrg>
<Derivative>
  <CreationDate>2003-10-13T17:21:35</CreationDate>
  <Description>All Star live Performance of Classical and 50's music at the 115th AES Jacob K. Javits Convention
Center</Description>
  </Derivative>
  <TrackLength>10:27</TrackLength>
</PhonoRecording>
</Embodiment>
```