

Rochester Institute of Technology

## RIT Digital Institutional Repository

---

### Theses

---

1-1-2003

## Regaining control through Digital Rights Management (DRM): What's in store for the music industry?

Gregory J. Romania

Follow this and additional works at: <https://repository.rit.edu/theses>

---

### Recommended Citation

Romania, Gregory J., "Regaining control through Digital Rights Management (DRM): What's in store for the music industry?" (2003). Thesis. Rochester Institute of Technology. Accessed from

This Thesis is brought to you for free and open access by the RIT Libraries. For more information, please contact [repository@rit.edu](mailto:repository@rit.edu).

**Regaining Control Through Digital Rights Management (DRM):**  
**What's in Store for the Music Industry?**

Gregory J. Romania

**Rochester Institute of Technology**  
**B. Thomas Golisano College**  
**of**  
**Computing and Information Sciences**  
**Master of Science in Information Technology**

**Thesis Approval Form**

Student Name: Gregory J. Romania

Project Title: Regaining Control Through Digital Rights  
Management (DRM): What's in Store for the Music  
Industry?

Thesis Committee

Name

Signature

Date

Prof. Dan Garrison  
Chair

12/15/03

Prof. Al Biles  
Committee Member

12/15/03

Prof. Steve Jacobs  
Committee Member

**M.S. GRADUATE THESIS**

**Submitted to the Faculty of  
The Department of Information Technology  
B. Thomas Golisano College of Computing and Information Sciences  
Rochester Institute of Technology, Rochester, NY**

**In Partial Fulfillment of the Requirements for the Degree of  
Master of Science in Information Technology**

**© Copyright 2003 Gregory J. Romania**

**All Rights Reserved**



# **Thesis Reproduction Permission Form**

**Rochester Institute of Technology**

**B. Thomas Golisano College  
of  
Computing and Information Sciences**

**Master of Science in Information Technology**

## **Regaining Control Through Digital Rights Management (DRM): What's in Store for the Music Industry?**

I, Gregory Romania, hereby grant permission to the Wallace Library of the Rochester Institute of Technology to reproduce my thesis in whole or in part. Any reproduction must not be for commercial use or profit.

Date: 12/11/03

Signature of Author: Gregory Romania

RECEIVED TIMEDEC. 15. 2:50PM

PRINT TIMEDEC. 15. 3:22PM

## Outline:

Topic	Page #
i Abstract:.....	6
ii Committee Members:.....	7
iii Acknowledgements.....	8
<b>Part 1:</b>	
<b>WHAT'S WRONG WITH DIGITAL CONTENT</b>	
I Introduction:.....	9
II The Nature of Digital Content:	
A. Information in a Digital Form.....	10
B. The Internet and the Portability of Digital Information.....	11
C. File Sharing.....	11
D. Content Ownership.....	13
III Digital Content is Threatening Contemporary Business Models:	
A. Convenience.....	15
B. Cost Savings.....	16
C. Demographics.....	18
IV What's at Risk?	
A. Online Piracy.....	18
B. P2P Application Popularity.....	19
C. Slump in CD Sales.....	20
D. Lost Revenue.....	21
V The Digital Millennium Copyright Act:	
A. DMCA and its Intentions.....	22
B. Taking Things too far.....	23
C. Lost Hope for a Legislative Guarantee.....	24
D. The Need for Technological.....	25

## Part 2:

### THE SOLUTION - DIGITAL RIGHTS MANAGEMENT (DRM)

VI	The Digital Rights Management (DRM) System:	
	A. DRM: What is it and why is it Needed?.....	27
	B. Stages of Intellectual Property Development.....	28
	C. Modes of Operation: Tethered vs. Un-tethered .....	30
	D. Introduction to the Technologies of DRM.....	32
VII	Technologies of DRM:	
	A. Encryption.....	32
	B. Digital Watermarks.....	35
	C. Rights Modeling Language.....	40
	D. Digital Certificates.....	43
	E. Secure Sockets Layer (SSL)/Transport Layer Security (TLS).....	49
	F. Other Protection Technologies.....	52
VIII	Pitfalls of DRM:	
	A. Complexity.....	54
	B. Standardized vs. Proprietary Solutions.....	55
	C. Human Factors.....	56
	D. Vulnerabilities.....	58
	E. Hurdles Created by Legislation.....	58
	F. Wide Spread Consequences.....	59

## Part 3:

### CONSTRUCTING A BUSINESS MODEL WITH DRM

IX	Paving the way for DRM:	
	A. What are the Needs.....	60
	B. More on Standards.....	61
	C. What Does this Mean for Business?.....	64
X	Building a Business Platform on DRM:	
	A. B2C Business Transactions and the Clearinghouse.....	64
	B. Super-distribution and the P2P Business Model.....	66
	C. Subscription Based Solutions.....	67
	D. Choice Boards – Giving A Customer Options.....	68
	E. Other Schemas.....	70
XI	Taking Advantage of Presented Opportunities:	
	A. Benefiting from DRM: The Music Industry.....	72
	B. A Win-Win Situation.....	73
	C. Taking Advantage of Business Incentives.....	75
	D. Controlling and Protecting Music.....	76

XII	Final Thoughts:	
	A. Timetable Expectancy.....	77
	B. Redefining the Industry: What is Music and Pricing?.....	80
	C. Gaining Momentum.....	89
XIII	Conclusion.....	90
iv.	Glossary.....	93
v.	Resources.....	97
vi.	References.....	100
vii.	<i>Appendix A</i> .....	104
viii.	<i>Appendix B</i> .....	105
ix.	<i>Appendix C</i> .....	106

## **Abstract:**

This paper, as part of the final requirement for the completion of a Master of Science in Information Technology at the Rochester Institute of Technology, will examine the current state of digital media content and its inherent problems with regard to rendering and distribution. Discussions will focus on the protection and sales of digitalized intellectual property through Digital Rights Management (DRM) while also concentrating on how these technologies can be employed to acquire copyright protection. Though much of the discussion may apply to a wide range of media types, e.g. – movies, software and digital books, the primary focus will be on music content. Part 1 of the paper will explore the current state of the music industry and the problems it faces, while building a case for the application of digital protection technologies that will ensure the integrity of digital music copyright ownership. The concept of DRM will then be presented in Part 2, with a focused discussion on several of the underpinning technologies. Strong emphasis will be placed on how these technologies can be utilized to reach the final goal, secure sales of online music content. The final section, Part 3, will examine how DRM can be applied by the music industry to safeguard their interests while promoting an online business. Case studies will be presented in an attempt to gain an understanding of the current state of the industry.

## **Committee Members:**

### **Chair - Daniel J. Garrison**

*Instructor*

email: [djg@it.rit.edu](mailto:djg@it.rit.edu)

phone: 585.475.6929

web: [www.rit.edu/~djgics](http://www.rit.edu/~djgics)

### **Reader - Al Biles**

*Undergraduate Program Chair, Professor*

email: [jab@it.rit.edu](mailto:jab@it.rit.edu)

phone: 585.475.7453

web: [www.it.rit.edu/~jab](http://www.it.rit.edu/~jab)

### **Reader - Stephen Jacobs**

*Assistant Professor*

email: [sj@mail.rit.edu](mailto:sj@mail.rit.edu)

phone: 585.475.7803

web: [www.it.rit.edu/~sxj](http://www.it.rit.edu/~sxj)

## Acknowledgements:

Special thanks go to my wife, Loreen and “the girls” Sammie and Tori, for their love and support through this project.

I would also like to thank my committee members: Professors – Garrison, Biles and Jacobs for keeping me on track and for all their valuable contributions. Also, thanks must go to many of the folks at ICSA Labs, for tolerating my endless questions and taking the time to discuss many of the details within this paper.

Finally, I must also thank the rest of my family for your support and encouragement.

## **Part 1:**

# **WHAT'S WRONG WITH DIGITAL CONTENT**

### **Introduction:**

#### **I.**

Copyright protection and the concern over content ownership expressed by those who create intellectual property have been an issue for perhaps as long as people have been putting their thoughts to paper. Intellectual property and the art of rendering and preserving that information for purposes of allowing others to enjoy and use, has been the foundation of the civilized world, as we know it. With the advent of the printing press an industry was born. It was now possible for information to be mass produced and readily shared with the vast population. Shortly after, it became clear that there was a concern and a need for the protection of proprietary works...thus the need for copyright protection and the early development of copyright law.

Enter in the age of digital processing. The ability to convert just about any piece of media into a digital representation of its material equivalent has opened the floodgates, once again, to the aforementioned anxiety over copyright infringement. The ability to easily reproduce and mass distribute information has brought about a new sense of urgency for the protection of ones intellectual, artistic, and or informational property. The Information Age has become a new point of contention to old laws and is challenging the might of those laws in this modern age.



Given that digital content is increasingly vulnerable to violation of copyright infringement and that the very nature of electronic data lends itself to misuse, it's not surprising that technologies are beginning to emerge that address these issues. The ease of distribution and replication can be detrimental to the interests of those creating digital content. In effect, this has challenged those copyright protections that have commonly been bestowed onto their tangible counterparts. It shouldn't be surprising then that the music industry, in particular, has been confronted with such a situation and that the industry has been demonstrating concern over its rights. These concerns, though, do not have to be the conditions under which the music industry continues to exist. By applying digital protection technologies, a model for an electronic means of copyright protection can be gained. Moreover, these technologies can be applied by the music industry in an effort to promote a diverse range of marketing and sales initiatives. DRM can prove to be a valuable tool for obtaining this reality, resulting in a lucrative online means of music distribution. Prior to discussing the technologies of DRM and their business implications, we should first gain a deeper appreciation behind the need for DRM.

## **The Nature of Digital Content:**

### **II.A.**

As was alluded to in the above introduction, anyone with access to a computer has been given the power to place information and content into digital form. The computer has made it possible to read, write, copy, alter, and store just about any type of media. This processing power is at the heart of the copyright problems felt by the music industry. Specifically speaking, music packaged in a digital form will exhibit qualities of convenience. This is regard to listening as well as copying, storing and transporting. Enhanced file formats are further adding to the ease

and convenience of this trend. The all-too-familiar MP3 file format can reduce sizes of music files on the order of 90% of the original audio file size, with virtually no loss in quality of sound. For example, an audio file that is 80 MB in size can be reduced to about five MB. With these compression rates, one can appreciate the potential for file storage and sharing. For example, consider a single 650 MB Compact Disk-Recordable (CD-R), with a capacity of approximately eight conventional audio files that are five minutes in duration. Using the MP3 file format, with its ratio of compression, will result in a CD containing over one hundred of the same time length files. [1]

## II.B.

Further adding to this phenomenon are the powers of the Internet. Creating a world where the interconnection of computers to a common network on a global scale has made it that much easier to share music files. Again considering the MP3 example, while this time including what the Internet brings to the table. With music files compressed at the rates mentioned above it shouldn't be surprising that the popularity of downloading music over the Internet has become so popular. Considering that a single five MB music file could be acquired in mere minutes over a dial-up connection. Imagine how many one could download with the availability of a Digital Subscriber Line (DSL) or cable modem where the bandwidth is far greater. Delivering MP3 compressed music files via these means have resulted in an explosion in the sharing of music files, greatly compounding the effects of copyright infringement on music content ownership.

## II.C.

Adding yet another piece of the puzzle to the overall piracy threat are applications that have made sharing music files over the Internet highly convenient and simple. One example of this is perhaps most evident with Peer-to-Peer (P2P) networks such as Gnutella. P2P networks

provide a mechanism to share and retrieve information between two or more parties. Though these networks are not specific to music they have been at the root of the piracy problem. P2P applications allow anyone with an Internet connected computer to easily share their music collections online and access the collections of others. Users of networks like Gnutella and the client programs that run on top of it, like Limewire and KaZaa can search for and download any music file that has been shared by other Napster users. Interestingly enough, P2P applications are only one part of the online problem the music industry faces. There are also a variety of other online sources available for downloading illegal copies of music. These would include services such as File Transfer Protocol (FTP) downloads, Instant Messaging or private file sharing servers, to name a few. Each of these alternatives, put together, serve to strengthen the illegal online music file sharing experience.

Adding to the overall problem is the fact that there is a multitude of evolving alternatives, to include, Kazaa, Gnutella and many others in the music P2P file sharing movement. Current estimates put the number of P2P file sharing applications above 130, and this only represents one of the many methods of downloading music files [2]. This evidence clearly shows that there has been a strong and steady rise in growth of P2P users. When the Internet P2P file sharing movement was first introduced, it quickly became apparent that its potential would be quite profound. Reports show that within days of releasing the first version of Napster there were over 10 000 people who had downloaded the application [3]. Another study points out that at the beginning of 2002 there were more than 2.7 million people, at any given time, utilizing P2P networks. These numbers only reflect two of the most popular P2P applications that were known at that time, namely Music City and FastTrack. Again this doesn't account for the vast number of options that are available. Further adding to this, statistics show

that in the year prior, there were on the order of eight billion music files swapped. This is certainly confirmation enough that there is a remarkable appeal to the P2P music file sharing movement and that music enthusiasts have flocked in this direction. [4]

These issues are of particular concern to the music industry because of the potential that exists over the loss of business and the effects of loss of compensation. They are being faced with an ever-growing problem with regard to their digital assets and the availability and portability of their digitally rendered music. As was stated earlier, the advent of the computer and likewise the Internet has negated many of the constraints imposed by physical based delivery formats such as - audiocassettes and CDs. If left unchecked, the popularity of music piracy will continue to grow and will only prove to prolong the ill effects of music copyright violations.

## II.D.

Another point that needs to be stressed is in relation to the ownership of music. This is a rather tricky issue when looking at it from the perspective of the industry as a whole. On the surface, one may simply consider that the artists who create the music are the sole owners, especially since they have the creative prowess. This however, is rarely true. Traditional means of creating a music product may involve several steps, with each step being carried out by different entities. For example, those involved with creating the music product often includes the following: artists, recording studios, producers, marketing agents and distributors.

The first phase in this process of creating a music product may require recording studio time. Once that phase is complete the product may be passed onto the record labels for packaging and marketing. Some of the names in this group would include – Universal Music Group, Sony Music Entertainment, EMI Group, Warner Brothers Music and BMG Entertainments. Each group involved in the production can claim a level of ownership through

their involvement in the process. Once the product passes through this stage it is forwarded onto a variety of distribution points. These would include entities such as retail stores, catalogue order merchants, or any other point of sale outlet where customers can get their music. Portions of the proceeds received from customer purchases are divided among all that were involved. Likewise, rights of ownership are divided based on agreements made between each party involved. Typically artists and musicians will sacrifice some, if not all, content ownership rights in order to gain the backing of the music labels who are better positioned to reach a greater audience. In the end, artists and musicians will only receive a small portion of the earnings gained from the sales of their creations. Technology, however, is beginning to change this notion. More power is being put back into the hands of those who demonstrate the creative energy needed to put together a music score. This will allow for them to regain a greater portion of their ownership rights and control over the content they create. Further adding to this are ownership-licensing agreements that can be enforced by technology.

An example of this can be illustrated through the Creative Commons initiative. Creative Commons is a means of providing the creators intellectual property, i.e. music, in a number of different ways. The range of available licensing options fall anywhere between freely available to fully restricted. Creative Commons goes one step further by coupling technology with their suite of licensing options. There are essential four levels to choose from. The first is what is known as "Attribution". This option basically states that one's property can be copied, published and freely distributed. The only requirement is that owner must be given credit for their work. The second is known as a "Noncommercial" license. This is similar to the first but stipulates that whoever uses the original content must not financially benefit from the material in anyway. The "No Derivative Works" option mandates that the content can be used but must stay intact. In

other words, no portion of the original work is permitted for use in the creation of any other work. The last option is called “Share Alike”. This license states that anyone is free to use another’s work in any way, just as long as the work derived from the original falls under the license agreement. A visit to their web site, <http://www.creativecommons.org>, will reveal more information on what options are made available. [5]

The site provides an interesting example, which specifically illustrates the licensing of a song. In short, the appropriate selection of a license would allow for the distribution of ones music creation under the terms and conditions that the creator of the original piece, selects. With the use of licenses and technology such as these, artists and content creators are able to maintain much of their individual rights to ownership. This is contradictory to the traditional means of distribution of music where some, if not all, ownership rights would to be relinquished to those that promote and distribute ones work. Services such as these are putting more control back into the hands of those who deserve it more. To view the Creative Commons illustration in its entirety please refer to the following URL <http://www.creativecommons.org/learn/licenses/how1>.

## **Digital Content itself is Threatening Contemporary Business Models:**

### **III.A.**

The nature of information in a digital form is also changing the way business is conducted. Several inherent qualities of digitized media are contributing factors. Convenience is gained through the ability of having ubiquitous accesses to the information that one seeks. This is accomplished on a global scale through the Internet. Further advantages of this relate to the elimination of time constraints associated with being physically bound to some entity or most any factors that one could imagine. The Internet, as it stands today, has made searching and

locating what one is looking for much easier and less time consuming. To illustrate this fact consider the differences of finding and acquiring music files between your local record store and the Internet. Customers can now browse for their favorite music selections through channels available via the Internet, while at the same time not being restricted by time and place. These same customers now have the ability to find and locate their desired selection from the comfort of their homes eliminating the need to jump in the car and drive to the local store, only to find that they have closed or that the CD they want is out of stock. Not only has the Internet made these conveniences a reality it has also made it possible to bring down costs associated with delivering the music product.

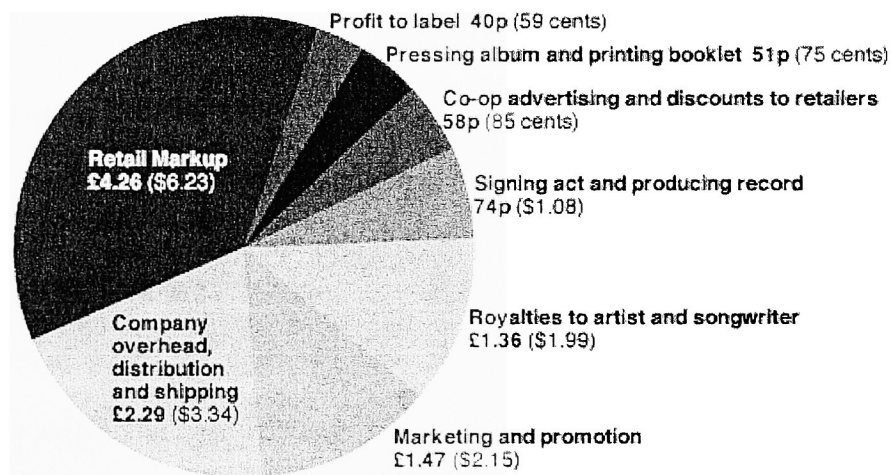
### III.B.

Cost savings associated with regard to monies needed for production and distribution will also be decreased. Production costs will be reduced, as the necessity to create pre-packaged materials for sales is no longer required. Consumers of music are becoming more accustomed to the digital file as a new commodity and the obvious reductions in costs to manufacture and distribute the content. With that said, the need to produce pre-package CDs and distribute them to retailers is dramatically reduced. The use of the Internet in-addition to industry adoption of the digital music file will allow for low cost, reliable and rapid delivery of their product. **Figure 1**, on the following page, illustrates the breakdown in costs associated with the creation of a single CD, which, on average, is around \$16.98 per unit according to Billboard Magazine [6]. Subtracting the dollar amounts associated with those costs that can be eliminated as a result: "Pressing album and printing" and "Company overhead, distribution and shipping" will see a savings of \$4.09 per CD. Customers should expect to gain at the very least a share of these savings if music is purchased via the Internet. Closer inspection of this graph will reveal other

possible savings as well. It's foreseeable that the reductions in the costs of "Retail Markup" will be realized as warehousing and rack space in retail stores will no longer be required. Some of those costs will be rolled over into online storefront development but should be much less expensive than real estate required for the former option. For these reasons customers are being driven to alternate means of obtaining their music. They have become aware of how inexpensive it is to produce the final product and have begun to demand a return on these savings. The PricewaterhouseCoopers Entertainment and Media Outlook 2003-2007 report states that in India customer demand has in fact lead to reductions in the price of CDs on the order of 40%. Interestingly enough this has resulted in an increase in sales [7]

**Figure 1**

The following is a breakdown of the different costs that go to make up the price of a £11.61 (\$16.98) CD, according to Billboard Magazine:



Courtesy – CNN.com (<http://www.cnn.com/interactive/entertainment/0101/cd.price/frame.set.exclude.html>)



### III.C.

Also needing consideration are the demographic relationships between music enthusiasts and users of technologies such as the Internet. Parallels can be drawn between those who are considered the mass consumers of CDs with those who are techno savvy. These folks tend to be, on average, in their late twenties to early thirties. Additionally, it is this generation who have what is generally referred to as disposable income, otherwise known as spare cash. With this in mind it should be no surprise that such a drive behind the online music trend has evolved into what it is today. The concept of technology driven change is not a new phenomenon and music sales are no exception. It is the combination of these new dynamics that are forcing the music industry to confront a change in their established business practices. These discussions focused on how business itself has been effected by technology. The next section will touch on what risks exist when information, or music, is available in digital format.

### What's at Risk?

#### IV.A.

The International Federation of the Phonographic Industry (IFPI) provided the following definition, found in **Figure 2** at the top of the next page, of online piracy [9]. As the definition suggests piracy is the unauthorized use of copyright material, which in turn leads to a deficit in the compensation to those who create, produce and/or distribute music. This has many far-reaching effects such as loss of legitimacy as a viable business, and threatens the reputation of artists and recording companies. In the end, piracy will only prove to hurt all involved encompassing the entire cycle from the consumers through to the recording labels.

**Figure 2**

The term of piracy is generally used to describe the deliberate infringement of copyright on a commercial scale. In relation to the music industry it refers to unauthorized copying and, in this context, falls into 3 categories:

- **Simple piracy** - is the unauthorized duplication of an original recording for commercial gain without the consent of the rights owner. The packaging of pirate copies is different from the original. Pirate copies are often compilations, such as the "greatest hits" of a specific artist, or a collection of a specific genre, such as dance tracks.
- **Counterfeits** - are copied and packaged to resemble the original as closely as possible. The original producer's trademarks and logos are reproduced in order to mislead the consumer into believing that they are buying an original product.
- **Bootlegs** - these are the unauthorized recordings of live or broadcast performances. They are duplicated and sold - often at a premium price - without the permission of the artist, composer or record company.

Courtesy – IFPI

#### IV.B.

One of the most telling statistics to support the notion that music piracy is taking place would be the sharp cuts in CD sales that the industry has been experiencing and have been brought on by a variety of contributing factors. The Japanese market alone has felt a 14% slump in prerecorded CD sales for the first half of the year [8]. The contributing factors to this are perhaps most notably due to the desire of music enthusiast to listen to their music at their PC or through other such devices such as portable MP3 players. What is taking place is that it is becoming more favorable for music to be in digital form where it is more portable and convenient. The computer and portable MP3 player have rapidly becoming the complimentary alternative to standalone stereo equipment. Likewise, making this transition has become a much easier choice as the quality of electronic components have improved while at the same time

prices have become competitive, or less expensive, than traditional stereo equipment. Furthermore, considering the time that people spend in front of the computer and/or the mobile nature of today's society has also contributed to this shift in customer desire. As a result, around a half of the U.S. population now listens to their favorite music through the computer or on the go [9]. Further contributing to this phenomenon is the availability of technology that enables people to copy store bought music CDs. The CD-R drive is a relatively inexpensive device, which enables one to cheaply copy manufactured music CDs. These indicators show that there is a definite trend toward utilizing the computer as a source of music entertainment. Though these examples show that the power of digital processing has made it possible for the average consumer to easily violate copyright ownership, it cannot entirely be placed on the shoulders of the consumer.

#### IV.C.

In some cases the music industry itself has brought on much of its own problems. Some record labels are building technology into CDs that restricts customers from playing their music from the CD-ROM drive within their computer. As a consumer, this will have the effect of pushing otherwise paying customers away from legitimate purchases and towards seeking music through alternative means, specifically due to the inconvenience. Ipsos-Reid, a company that conducts market research, has shown that in 2002 approximately sixty million Americans have downloaded music from online resources. To get a better appreciation for the magnitude of this number, consider that it represents 28% of the U.S. population. Also, consider that this is small when compared with the statistics collected from other countries around the world. Refer to Appendix A for a chart showing the percentage breakdown of pirated units per pre-manufactured units of music. Note that the U.S. is in the category with the lowest percentage [11].

Contributing factors to this issue are the customers are demanding cost breaks as we have seen in section III.B, found above. Whatever the reasons, it is apparent that people are transitioning away from a desire to purchase and use CDs. It is quite evident that the music industry is experiencing a decrease in sales of CD formatted music and that the industry as a whole is suffering from missed sales. This, however, has been combated with price adjustments as seen in the PricewaterhouseCoopers Entertainment and Media Outlook 2003-2007 report suggests that customers will buy music if they feel that prices are fair. [12]

#### IV.D.

What does this mean in lost revenue with regard to the music industry? First, note that accurately quantifying any such loss is next to impossible when considering the number of options that are at our disposal at any given time. The International Federation of the Phonographic Industry (IFPI), a global consortium of music producers and distributors, has however calculated losses based on several different suspect contributors attributing to the downturn in CD sales. These numbers are based on data captured through seizures of illegal CD copies destined for black-market sales and does not account for any type of Internet download and/or customer generated CD copies. The music industry overall has lost on the order of \$4.3 billion dollars in 2001 [13]. When considering that the entire industry enjoys yearly revenues on the order of 33 billion, one can see that these estimated losses are a representation of a rather large piece of the pie [14].

These numbers are telltale signs that losses are being incurred and that action needs to be taken. This is evident through a variety of emerging solutions that can be explored and used in an attempt to attain the copyright protection. These solutions come in two distinct flavors –

legislation and technology. Prior to delving into the technological options under the DRM umbrella a brief discussion on developing legislative alternatives will follow.

## **The Digital Millennium Copyright Act:**

V.A.

One of these solutions is the Digital Millennium Copyright Act (DMCA). Introduced in 1998, it was developed in an attempt to address modern day issues and add to the existing copyright law's provisions that address advancements brought on by technology. This necessity was driven by the need to update current copyright laws that are no longer proving to be

**Table 1 – DMCA Outline**

- Makes it a crime to circumvent anti-piracy measures built into most commercial software.
- Outlaws the manufacture, sale, or distribution of code-cracking devices used to illegally copy software.
- Does permit the cracking of copyright protection devices, however, to conduct encryption research, assess product interoperability, and test computer security systems.
- Provides exemptions from anti-circumvention provisions for nonprofit libraries, archives, and educational institutions under certain circumstances.
- In general, limits Internet service providers from copyright infringement liability for simply transmitting information over the Internet.
- Service providers, however, are expected to remove material from users' web sites that appears to constitute copyright infringement.
- Limits liability of nonprofit institutions of higher education -- when they serve as online service providers and under certain circumstances -- for copyright infringement by faculty members or graduate students.
- Requires that "webcasters" pay licensing fees to record companies.
- Requires that the Register of Copyrights, after consultation with relevant parties, submit to Congress recommendations regarding how to promote distance education through digital technologies while "maintaining an appropriate balance between the rights of copyright owners and the needs of users."
- States explicitly that "[n]othing in this section shall affect rights, remedies, limitations, or defenses to copyright infringement, including fair use..."

Courtesy - UCLA

effective at providing appropriate security of copyrighted material. UCLA's Online Institute for Cyberspace Law and Policy department has put together a list of the most important issues related to the DMCA, please see Table 1 above [15]. On a very basic level, the DMCA establishes guidelines that address issues related to the acceptable use of digital copyrighted information and the management system behind this information. Specific to the music industry are provisions that address the use of digitally rendered music content and the prohibition of developing technologies that circumvent encryption techniques, which carry the intentions of copy protecting music. For a more in-depth examination of the DMCA refer to the U.S.

Copyright Office publication entitled "The Digital Millennium Copyright Act of 1998: U.S. Copyright Office Summary" located at - <http://www.loc.gov/copyright/legislation/dmca.pdf> [16].

The guidelines outlined under the DMCA were developed as a tool to protect the interests of content creators however these same rules are taking an opposing approach and are failing to meet the needs of those whom legally purchase media.

## V.B.

Though the provisions outlined above give the impression as being reasonable and just, further investigation into the implications behind these reveal otherwise. Many feel, principally consumer advocates, that some of the provisions outlined in the DMCA are misguided and may do more harm than good. Moreover, much of what the DMCA dictates will undermine competition, consumer rights, and innovation itself. Contained in a report written by the Electronic Frontier Foundation (EFF) there are three specific "Unintended Consequences" of the DMCA. These are as follows: stifling of scientific research, jeopardizing fair-use and impeding competition and innovation. First, scientific research would be stifled by the DMCA by

prohibiting research and development of information delivery technologies under the anti-circumvention clause. The second issue relates to the consumer whom legitimately purchases music and the fair-use of that content. Under these provisions a consumer's right to make personal "non-infringing" copies of purchased material as well as the right to first sale, both of which are permitted under existing copyright laws, will be jeopardized [17]. Finally, there are the issue related to negative impact on competition and innovation. It is generally felt that some of the DMCA directives, specifically related to technology circumvention, can be used by some organizations to effect the direction of their competitors. For example, suppose that a popular music label elects to develop a new player as part of a strategic marketing plan. Encryption is also incorporated as part of the design, which serves to protect copyright ownership of the music stored on the player. Under the DMCA, another label would not be permitted to reverse engineer their competitor's product in an effort to enable entry into that new market. This in and of itself would suffocate innovation and competition. With that said, it is obvious that the DMCA has some shortcomings and that there is a need to rethink some of the provisions. [18]

## V.C.

As with any new legislation there will be hurdles to overcome. In an attempt to counter some of what was mentioned in the discussion above there are new legislation proposals being developed. One such proposal has been presented to Congress in January of this year. A new bill known as the "Digital Media Consumers' Rights Act" (DMCRA) will attempt to define and regain "fair-use" rights lost under the DMCA for those consumers whom have legitimately purchased music. These emerging legislation will even more muddy the waters for the clear sailing of the DMCA for the near future. [19]

Further adding to questions of effectiveness having to do with to the DMCA are matters of international boundaries. The DMCA is legislation that attempts to address a global problem with limited reach. Provisions and laws that are dictated by the DMCA only apply to the United States and do not consider that the problem at hand is a global matter, due the reach of the Internet. So even in its strictest form, the DMCA alone will not be effective in controlling copyright protection on this scale. It is quite evident that laws are behind the technological curve. Therefore, if the music industry hopes to rely on legislation as the sole means of providing copyright protection, it will have to be willing to wait until legislation matures to the point where it catches up to technology. [20]

V.D.

The key to consider here is that digital music hungry customers are now fully aware of what is available and have come to expect what they want. The cat is out of the bag, so to speak, and customers are going to be beginning to demand that music be made available online. Furthermore, there has been a lot of work done on legal means of guaranteeing the protection of music content. However, this has not been expeditious enough to keep up with current state of technology and demand. As was previously discussed, legislation alone will not be enough to combat online music piracy. The music industry will need to also rely on other methods of protecting their intellectual property. This will be in the form of technological options, which will play a major role in controlling music content and thus protecting the interests of the artists, recording studios, and record companies alike.

These methods are the technologies of DRM. Technologies, when utilized, can be the solution that artists and the recording companies are looking for and can rely on to protect their intellectual property. The next section, Part 2: "The Solution Digital Rights Management



(DRM)", will explore the technologies that the music industry may use in order to thwart copyright infringement. Once presented, follow-up discussions will investigate how these technologies can be used to promote online sales of music.

The remainder of the page intentionally left blank.

## **Part 2:**

# **THE SOLUTION – DIGITAL RIGHTS MANAGEMENT (DRM)**

### **The DRM System:**

#### **VI.A.**

The DRM movement sets out to define a set of technologies and the usage methodologies of a system that will provide a means for digital copyright protection. It is hoped that by utilizing DRM, an online environment suitable for the secure distribution of digital media with the ultimate goal of nurturing an environment suitable for conducting electronic commerce will be made possible. This will come to fruition through the creative use of a variety of existing and emerging technologies. Content owners will then be able to use these technologies to enforce an assortment of allowable usage rules. The following quote retrieved from Macrovision's web site may best sum up the underlining goals of DRM [21]:

"Digital Rights Management (DRM) is an emerging and vital business concept driven by the need for secure electronic distribution of high-value digital content. In its purist form, DRM provides a technology platform to allow trusted packaging, flexible distribution and managed consumption of digital content over electronic networks."

In short, DRM brings about a technological solution required in today's online community, especially if the Internet is to support a viable platform for electronic commerce. As was made evident earlier, these solutions are arising out of a compelling need for the protection of copyrighted digital works. Reiterating that this is predominantly due to the fact that the Internet has proven to be a place where piracy can thrive, and one that is continually challenging

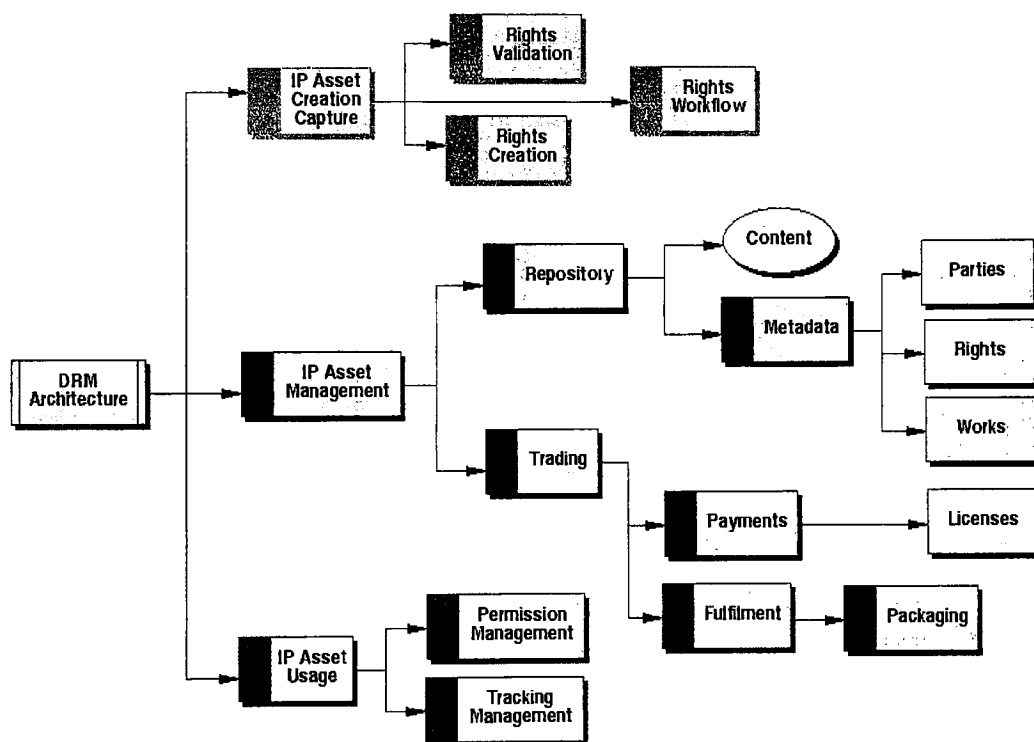
established copyright laws. Moreover, the key aspect of a DRM system is not merely the protection of proprietary works, but rather just compensation for the efforts of content owners and creators. The many underpinning technologies of DRM will provide a viable platform and ensure that commerce through electronic channels will become a reality. The following discussion will first concentrate on how a DRM system will be structured and then the technologies themselves will be presented. Special consideration will also be placed on several of the issues found through the online business lifecycle. As the definition above implies, there are several distinct goals that content owners set out to gain through the use of DRM. Each of these areas will fall within one of three critical points of existence within the life of a piece of Intellectual Property (IP).

## VI.B.

There are essentially three areas within the intellectual property lifecycle where DRM can be introduced in an attempt to achieve content protection and to establish a platform on which digital material can be managed. This approach is applicable to many types of media, above all music content. Each of these areas takes into account the specific state that a digital music product is in at any given point in time. These areas include “IP Asset Creation and Capture, IP Asset Management and IP Asset Usage”. Each of these areas defines specific tasks and treatment of the music content along the IP lifecycle, as it makes its way to the consumer. **Figure 3**, found on the next page, provides a graphical representation of the discussion to follow. It is during the “IP Asset Creation and Capture” stage when it is decided how the music will be managed and what usage rights will be assigned to a particular music piece. Usually, the recording studios and/or record labels will fall into this realm. It is at this point that the DRM system will be used to place controls into the music, detail copyright ownership, as well as define

how the music should be permitted to be used. The next step involves the actual management of the music product once it has been created and appropriate rules have been assigned, the “IP Asset Management” stage. This can be looked at as an intermediary stage where the final music product is packaged, marketed and distributed. This is also one of the points where enforcement

**Figure 3**



Courtesy – D-Lib Magazine

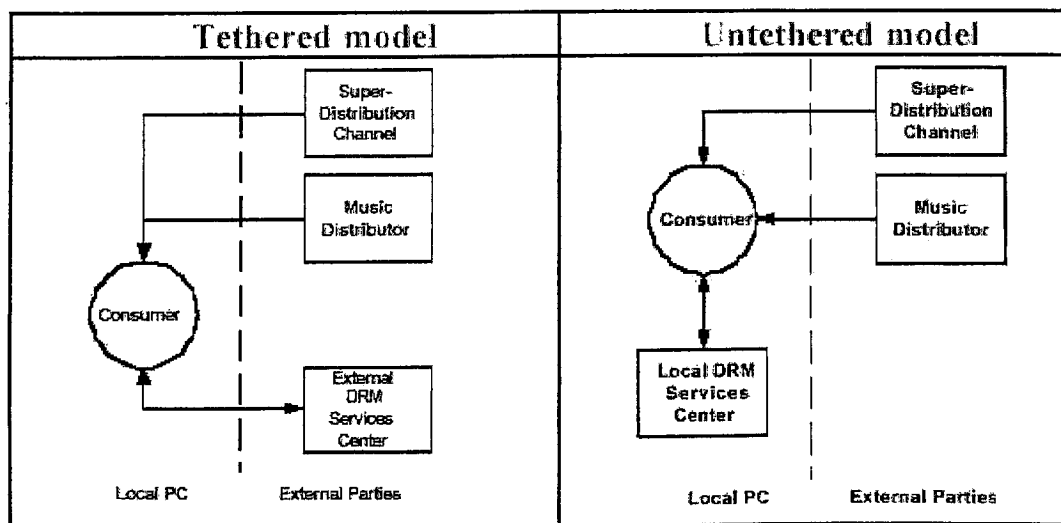
of the previously assigned rules may be engaged. One example of this could include subscription-based offerings where customers “tune” into a service that sends customers their music, such as Internet Radio. Under this scenario usage right will be controlled directly by a clearinghouse that is responsible for content management. The last step in the intellectual property lifecycle is the point when the music product itself is in the hands of the customer, IP

Asset Usage stage. An example of this would be the purchase of MP3 files for download and saving to their personal collection for later playing through for to the customer's media player. Unlike the previous example such a DRM solution will have to interpret and enforce the assigned rules through a customer's equipment. These last two steps are the most critical for the protection of intellectual property. It is at this time that permission controls will be placed on the music content that will govern when, how and by whom a purchased piece of music will be used. As one may begin to notice, the last two steps within the IP lifecycle bring about some interesting methods for the distribution of music. [22]

## VI.C.

The music industry, through DRM, will have at its disposal two distinct business models that can be explored for distribution of music content. These schemes are defined as either tethered or un-tethered. The primary difference is in how a customer interfaces with the DRM system. Consider the example found in **Figure 4**. This depiction of these types of business

**Figure 4**



Courtesy – Sai Ho Kwok paper on Digital Rights Management for Online Music Business

schemes can be used to illustrate the two distinct models that can be explored with DRM. A tethered model would consist of a system where the music to be purchased is provided by a central repository and distributed from that point. A customer would first interact with such a distributor by locating and making payment for their music selection. Once this has been accomplished the music content will be delivered to the customer under the conditions agreed upon. Again this can be illustrated with the Internet Radio example, where a customer would then listen to their purchased selection through a clearinghouse. Such a system would require that the consumer have an active connection to the music repository anytime there is a desire to listen to music. [23]

An un-tethered business model on the other hand would create a situation where the music content can be freely distributed across the Internet in standalone file format. With a scenario such as this, anyone would have access to the music files. This music, however, would be worthless without receiving the proper permissions that are necessary to use the content. Under the un-tethered model, a required license would grant the necessary authorization for listening to the music within the file. This "license to use" in most cases is transported along with the music content. This information will then be interpreted by the music enthusiast's media player, such as a Personal Computer (PC) or portable playing device, and acted on accordingly. The main advantage here is that the consumer does not have to be connected a clearinghouse to enjoy their favorite piece of music.

Each of these models discussed present unique opportunities for the selling of music through online channels. The specific technologies used will dictate the type of business model that can be adopted. Prior to an examination of how the music industry can utilize DRM in an

effort to create a legitimate online existence, an understanding of those technologies that are best applied to the music industry should proceed. [24]

#### VI.D.

It should be noted first that there are a variety of technologies that make up DRM. Moreover, DRM is not solely for the protection of material found online, but rather its intentions are directed at the protection of all types of media that are found in a digital format. These could include, and are not limited to, software packages, news articles, ebooks, video or music entertainment, all of which can be found in any delivery format. Each media type and/or delivery format will be exposed to a different and unique set of threats to the validity of its copyright protection. Specific technologies will be required for each of these types of media. The technologies of DRM technologies will also come in a variety of forms ranging from solutions based on software to those based on hardware. Furthermore, many of these technologies will apply to a diverse cross section of media types, though not all will be suited for music content. The ensuing discussions will focus on those technologies that will be best suited for the protection of online music content.

### **Technologies of DRM:**

#### VII.A.

The following technologies to be summarized will offer a wide range of options over how a music product can be controlled, protected and sold through electronic means. **Table 2**, found below, lists some of the technologies that are available. The subsequent discussion will include a

**Table 2**

Encryption
Digital Watermarks
Rights Modeling Language
Digital Certificates
Secure Socket Layer (SSL)/Transport Layer Security (TLS)
Other Protection Systems

look at each of the presented technologies and will further elaborate on how they may be used to support the music industry's interests.

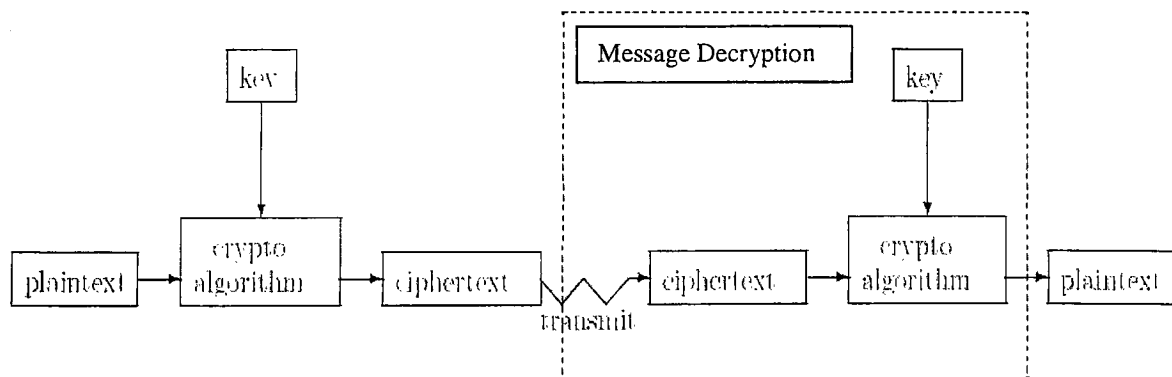
Encryption creates the foundation on which many of the other technologies are built. It is a technique used for protecting information dating back to the time of Julius Caesar. Caesar used a basic form of encryption to send messages that were unintelligible to anyone except the intended recipient. The art of encryption is a process by which data is transformed into a form that is meaningless to anyone without the proper privileges to consume that data. During Caesar's time the code for encrypting messages was a simple shift of the characters within the alphabet. Those who were privy to this code of character shifts were then able to decipher the original message. Not a very sophisticated system, but none-the-less effective. Modern day encryption is much more complex and a full discussion is outside of the scope of this paper. However, a brief summary should be provided in an attempt to understand the intricacies of why this technology would be beneficial to the music industry under a DRM solution.

Electronic encryption is fundamentally similar to the Caesarian system in that, like characters of the alphabet, the base units that make up a digital file are randomized in such a way that the original content is meaningless. On a very basic level, an electronic cryptographic system will take a piece of information, music content in our case, and mathematically combine it with another piece of information, usually in the form of what is known as a key. It is the process of combining this key with the original content and running it through a cryptography



algorithm that creates a form of the original content that will be useful only by the intended recipient. A crypto algorithm is a special computational “recipe” that a system would use in order to encrypt information. This recipe contains the instructions and computational specifications that, when followed, render the content encrypted. There are many such algorithms to consider, for example, Triple Data Encryption Standard (3DES), Advanced Encryption Standard (AES), Blowfish and many others. Under most crypto systems it is either the original key or a mathematically related form of that key that will be used to decipher the encrypted form of original content. **Figure 5**, found below, depicts the process a crypto system would follow in order to encrypt information. Note that, regardless of the type of media intended for encryption (plaintext, music or any digital content) the process will remain the same [25]. The underlying goals of these functions are to safeguard information as it is passed from one location to the next, i.e. music content to the customer.

**Figure 5**



Courtesy – Mark Stamp paper on Digital Rights Management: The Technology Behind the Hype

The music industry will be able to explore the utility of encryption by harnessing its power through the generation of secure music files. What will be gained from this will be an immunity to copyright violation as a result of music content being maintained in an encrypted

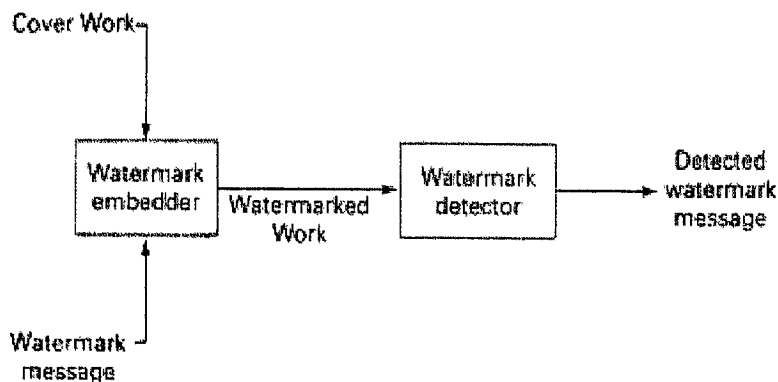
form. The ramifications of this are that the music industry will be able to overcome the problems associated with the many illicit copies of music. Most notably those experience with the many illegal music-swapping operations that are available. Additionally, the music industry will gain from persistent protection against copyright infringement. This is where the music content will always be protected regardless of the fact that the files carrying the content will continue to be available though widespread storage and distribution over the Internet. Only those with the proper credentials, i.e. decryption keys, will be able to listen to the music. Obtaining these necessary credentials will be made through purchases, thus revenue generation and just compensation to those creating, producing and distributing the content. With this said, one may be under the impression that encryption, by itself, will be sufficient however this is not the case. Through it can be extremely effective at protecting the integrity and confidentiality of music while in storage or transit this is where the buck stops.

Encryption by itself will not be enough to build a DRM system capable of providing foolproof copyright protection let alone construct a system robust enough to support a business model capable of selling music goods. Additional layers of functionality and protection must be put into the system so that management of the music files can be achieved; both while in transit and once the music has reached their destination, such as those to be discussed. This is due to the fact that once the music has been decrypted the user can do what they want with the content.

## VII.B.

Another useful technology for application to music content is the digital watermark. This technology consists of a technique by which another piece of information is embedded within the original piece of content, itself. See **Figure 6** below. Careful selection of the information to be

**Figure 6**



Courtesy - Ingemar Cox, Matthew Miller and Jeffrey Bloom

included within the watermark message can then be used to further support the music industry's objectives. One of these uses includes the communication of supplemental information to be used by the DRM system in conjunction with specific business plans [26]. This could come in the form of allowable usage rights, file-handling doctrines, or business supporting information (more on this later). These technologies are a subset of a larger body of science known as steganography. Steganography can be used in a variety of ways and is applicable to many types of media. An appreciation of the concept of a watermark can be gained by examining one of the newly designed U.S. five dollar bills. An image, other than Lincoln's original portrait on the face of the bill, can be observed. To do so, hold the bill up to a source of light and peer through. What emerges is another image of the 16<sup>th</sup> president of the United States of America that appears to be imbedded within the bill itself. Much like digital watermarking, this image was designed into the new currency for some of the same reasons: to stave off counterfeiting and provide a mechanism for detecting the authenticity of the currency. [27]

Similar to encryption, digital audio steganography has, at its disposal, a number of sophisticated algorithms or techniques that can be employed to insert watermarks into music

content. Many of these are based on signal processing. This can occur while the music is in either a digital or analog form. For instance, one of these methods embeds watermarks into a music file as it is being digitized through the Pulse Code Modulation (PCM) process. This technique basically creates the watermarked music file by inter-mixing the digitized signals of both the original music content and the watermark information [28]. Another technique being explored is a Spread Spectrum processing approach where scaling of either the time or pitch component of the signal are manipulated [29]. Regardless of the technique used the principle concern with using audio watermark solutions will be associated with the portability and interoperability across a wide assortment of music playing devices or applications. If left unchecked a large assortment of watermark implementations may emerge. Standards must be adopted otherwise a number of different algorithms will need to be built into these music players. This would cause the watermark approach to DRM to become more complicated than is required.

As was noted earlier, the digital watermark is not intended for the protection of music content while in transit, but rather for providing a means of transmitting information along with the content. This will lead to a variety of business opportunities that the music industry will have at its disposal. For example, using this information with a player device that is able to read and interpret digital watermarks it will possible to control how that music is handled at the customers end. It is important to note at this point that the watermark is only useful for passing instructions and/or additional information about the music content itself. This is unlike encryption technology where the content is protected only in transit and while not in use. What can be said for digital watermarking though, is that the information passed along with a file can be used by a DRM system to satisfy a variety of business objectives.

**Table 3** below, illustrates some of the business uses of digital watermarks. Content identification will be one of the byproducts gained through the use of digital watermarks. As

**Table 3**

Content Identification
Transaction Identification
Usage Control
Other Information

was stated earlier, content fingerprinting can be utilized to prove authenticity of the music. Coupling fingerprinting with an identification mechanism, it is now possible to associate a music work with content owners. By identifying information related to who owns and/or distributes music content, it is then possible to track the product throughout its lifecycle. What's more, this tracking information could then be used as a means to support systems designed for payment collection. The end result is just compensation to the proper copyright owners. Transaction identification, another use of watermarking, will result from embedded information related to how and when a customer is permitted to use a music file. Another byproduct of digital watermarking would be the attachment of information that can be used to dictate control over allowable usage. The information contained in the watermark could be extruded from the content and interpreted by a compliant music player. Once these instructions have been obtained, the player would then apply the appropriate controls. Combining the use of watermarks with technology that can understand the embedded information creates a situation where the music content within the file can be controlled in a number of different ways. Examples of controllable characteristics could include: who can listen to the file, the number of times a particular music file could be played and whether or not the file could be saved or sent to

another person. Other information can also be sent through digital watermarks. Marketing data and statistical usage information can be passed along with the music files. This gives the distributing and marketing companies the tools to further enhance their offerings. Using marketing information, the watermark could also be used in conjunction with incentive programs. For example, samples of alternative pieces of music, lyrics information or other types of marketing communications could also be passed along with the originally purchased music through the watermark. As shall be seen in the business section of this paper, Part 3, these techniques can be used to generate further music sales. It's also worth noting that, if this technology is being used for tracking the music files, the isolation of illegal distribution operations may also be possible.

This leads back to the use of digital fingerprint information, which can be place within a watermark for content identification. The fingerprint will consist of a piece of information that is related in some way, usually through mathematical computation, and provides a unique identification of the original content. This creates a unique Digital Object Identifier (DOI), which is used to distinguish and assure that the content being received is an original and authentic work. The watermark can act as an identification mechanism so the DRM system is configured to utilize it as a check against the original data and distribution point. If the file is found to be pirated and/or an invalid replication, it could be destroyed. [30]

Another of the more imperative requirements for the effective use of digital watermarking is that the embedded information should not in any way be detectable or disruptive to the original music file. In other words, for purposes of the music example, the digital watermark must not affect the audio quality of the original music content. Much like the five-dollar bill example, the face value of the bill has been keep intact while supplying additional

information through the embedded watermark. Yet another condition for success is that digital watermarks must exhibit qualities of persistence. This means a digital watermark must be resistant to its removal from a music file and also to being altered in any way that could result in it being ineffective. If either of these conditions were permitted to take place, the system would be subject to the bypass of the intended security measures. Setting aside these requirements it can be said there are several opportunities presented through the use of watermarked digital music files. Referring once again to **Figure 6**, it is plain to see the information contained in the "watermark message" can be used to transfer an untold amount of messages that could support copyright protection with the added benefit of providing an additional channel for marketing initiatives.

## VII.C.

Yet, another approach being developed to support the DRM movement is the Rights Modeling Language (RML). Unlike cryptography or steganography, the RML approach does not directly alter the information that is to be protected. Instead, a system based on RML will act as a gatekeeper, protecting and assigning usage rights at both the distribution and consumption ends of the spectrum. In other words, RML is an interpretive language geared toward dictating permissible usage of a given piece of data. Though these languages do not provide a direct means of protecting digitized music, by working together with technologies such as encryption and watermarks it will be possible to develop solutions that promote the sale of music over the Internet. Many of these interpretive RML based solutions are beginning to emerge. Several of which are proprietary and others based on open-source formats. Some of the more prevalent RML offerings would include the Digital Rights Property Language (DRPL), Open Digital Rights Language (ODRL) or the eXtensible Rights Markup Language (XrML). Many of these

solutions are emerging and are rapidly gaining industry support and forward momentum. Considering that most RML's are fundamentally alike in their intent, and since XrML is receiving support from standard setting bodies such as the Organization for the Advancement of Structured Information Standards (OASIS), a focused discussion of this particular example will follow.

XrML builds upon the functionality of the eXtensible Markup Language (XML), which was developed as the next generation of document expression language. The purpose behind its development was to create a rich and interactive means of content delivery. Adding to this notion, XrML further enhances the technology of XML by building into the language the ability to place stringent controls over the information being exchanged. These enhancements and controls are made possible by sending additional information in the form of metadata. This metadata is essentially language instructions, which are sent along with the data in question. An XrML aware device, Windows Media Player for example, will interpret these instructions and apply the specified constraints on the original content. It is these instructions that tell the language interpreter how the content should be handled and dictates the allowable usage details. **Figure 7**, found below, outlines some of the many language instructions that can be included in XrML metadata. This catalog of instructions shows that XrML can be used to impose a comprehensive list of controls on electronic content. It also shows a variety of tools are available to support financial transactions.



**Figure 7 – XrML DRM provisions**

Digital Property Rights  
    *Transport Rights*  
    *Render Rights*  
    *Derivative Work Rights*  
    *File Management Rights*  
    *Configuration Rights*  
Specifying Times  
    *Specifying Moments in Time*  
    *Specifying Units of Time*  
    *Specifying When Rights Can Be Exercised*  
Specifying Fees and Incentives  
    *Currencies and Accounts*  
    *Digital Tickets*  
    *Per Use and Metered Fees*  
    *Best-Price Fees*  
    *Markup Fees*  
Specifying Access Controls  
    *Digital Licenses (Certificates)*  
    *Security Classes*  
Specifying Watermark Information  
    *Watermark Strings, Tokens, and Objects*  
    *Examples of Watermark Specifications*  
Bundle Specifications  
    *Specifying Time Limits Inside Bundles*  
    *Specifying Fees Inside Bundles*  
    *Specifying Access Inside Bundles*  
    *Specifying Watermark Information Inside Bundles*

Courtesy - Xerox Corporation - <http://xml.coverpages.org/DPRLmanual-XML2.html>

Particularly XrML can be used to enforce usage rights that dictate controls over time and frequency of use. Also possible are instructions that allow for the application of associated fees and the collection of those fees. What may also become apparent through observing this list of language instructions is that several technologies are now beginning to work together. This is evident with built in provisions for the use of digital watermarks. This allows for more robust functionality in support of an acceptable DRM platform on which electronic commerce can be

built. There are, however, still pieces of the puzzle missing, though. Although XrML may excel at administering allowable usage rights on music content and the collection and tracking of sales information, it is lacking a means to prove the identity of all entities involved in the transfer of digital music goods.

## VII.D.

Some of the more crucial pieces of an online exchange between music distributors and customers will be the acquisition of identity, proof of the authenticity of those identities and the establishment of trust relationships [31]. These requirements are necessary due to the anonymous nature of the Internet. Though some business models, such as those based on super-distribution (to be discussed later) will not require identification due to the inherent design of the system, many other implementations will. Therefore the solutions that depend on these requirements will need some technological mechanism to assure music distributors of the identity of their customers. Without this ability they will lose a level of control over their product. The success of such online music sales implementations will be dependant on distributors having knowledge of who their customers are, and gaining control over their access to their product. To accomplish these tasks the music industry has at its disposal a technical solution know as a digital certificate. Not only will digital certificates make possible the trusted identification of customers but will also provide a variety of business supporting functions. Some of these may include the functions outlined in **Table 4** found below. Each will be applicable to the sales of music and can be supported with the use of digital certificates [32]. The discussion to follow will take a closer look at digital certificates and how the music industry can use them to protect their interests, specifically by achieving the certainties and assurances found in **Table 4**.

**Table 4 – Functions of Digital Certificates**

• Certainty of the quality of information sent and received electronically.
• Certainty of the source and destination of that information.
• Assurance of the time and timing of that information.
• Certainty of the privacy of that information.
• Assurance that the information may be introduced as evidence in a court of law (non-repudiation).

Courtesy – Articsoft

The discussion to follow serves to give the reader a general understanding of how digital certificates work and enough information to understand how this technology can be applied to the online sales of music, it is not meant to be exhaustive. Pointers to resources of further investigation will be presented where applicable. As with the technology industry, the science of digital certificates is jargon intensive, therefore, a few key terms will be presented.

The first term to be introduced, and the one that outlines the foundation onto which digital certificates will be used, is asymmetric cryptography. This is a class of cryptographic system that is based on the use of two distinct encryption keys, namely a public and a private key. Such a system, with the aid of other functionality, will allow for the sharing of encryption and identification information between two unrelated parties. The asymmetric nature of this class of system arises through the fact that there is two separate, but mathematically related, encryption keys. Special algorithms are used to create these key pairs. Another important fact to keep in mind is that, though there is a mathematical bond, they are distinct keys nonetheless. The public key would be distributed to any party with whom the owner of that key would like to securely communicate or transfer information. The private key, on the other hand, is kept secret and used solely by the owner for purposes of decryption and digitally signing messages. This differs from conventional encryption systems where only a single key is used. One of the

problems with the single key, or symmetric cryptography, scenario is that only a single encryption key is used for both encryption and decryption. There are many problems with this type of system, to include the fact that there will need to be some off line mechanism for distributing the encryption key. This simply will not suffice in the online environment of digital commerce where encryption information will need to flow between distributors and their vast amount of customers. This is where asymmetric cryptography will be better suited for use with digital certificates, though this alone will not be sufficient. Building upon asymmetric cryptography are digital signatures bringing digital certificates closer to fruition. [33]

A digital signature is a piece of information that is mathematically related to the information or content to be sent. Similar to the handwritten signature digital signatures are used to authenticate the identity of the originator of the signature. Therefore, the digital signature can be used to prove the source of the information being received. On a very basic level, a digital signature works by taking the message to be sent and performs a special computational algorithm known as a hash. This hash algorithm results in a message digest, which is a mathematically related fixed length output of the original message [34]. Once the message and the signature are sent to their destination, the recipient should acquire the same results when they run the same algorithm against the message. It's important to note that the original data cannot be extrapolated from the message digest. Also, since the message digest is created with the original piece of information, any tampering or changes in that information will be revealed upon verification of the digital signature. Once the message digest creation step has been completed the message digest itself is then encrypted with the sender's public key. It is the completion of these functions, in their entirety, that make up the digital signature. The signature can now be used for a variety of functions. One of these uses would include guarantees of the integrity of

the original piece of data. This would provide assurances to the recipient that they have truly received what was sent. Digital signatures will also assure the recipient of the authenticity of the sender. This arises though the fact that the sender encrypts the message digest with his or her own private key. It is through this process that the recipient can gain a level of certainty, because only the associated public key can be used to decrypt the digital signature. So far, only identification of the source and a check of the integrity of the message sent are made possible. There currently is not yet enough functionality to provide for trusted relationships. This is where a trusted third party will be used.

A digital certificate can be viewed as the electronic equivalent of a traveler's passport. Both a passport and a digital certificate are intended for identifying and establishing confidence in that the holder of either the passport or digital certificate is genuine. In the case of a passport, proof of identity is accomplished through the association of a given individual with their passport. The backend processes, i.e. application, background investigation, etc. all contribute to the end result; trust in that the holder of the passport is authentic. Additionally, similar to the passport, a level of trust can be gained through additional layers of functionality. In both cases trust is established through the receipt of a "stamp of approval", usually generated by a third trusted party. Once again, in the case of a passport this would be the agent who verifies the passport application and then issues the appropriate documents. In the digital realm the Certification Authority (CA) will handle this functionality, in addition to many others. It is the CA that handles the assignment and verification of digital certificates. The CA is therefore synonymous with a passport-issuing agent. For the system to work, however, the CA will need to access and gain information about the parties that would like to transfer data, music for purposes of this discussion.

A digital certificate consists of a number of unique pieces of information. The certificate, as it applies here, is a container that holds a collection of these pieces of information. Included within this container may be information such as the owners public encryption key, the digital signature of the certificates issuer (typically the CA), information related to the owner of the public key (possibly a registration, customer number or any other type of identification) and information associated to the key itself: key length, algorithm used and dates of validity, to name a few. It is with the exchange of this information that customer credentials can be verified and assurances of their identities are made possible. This subject, in of itself, is a rather complicated one. For those interested in more information on digital certificates, please refer to the Internet Engineering Task Force (IETF), Request For Comments (RFC) number 2459. As was previously indicated the digital certificate is only one piece of the puzzle. Enter back into the picture the CA. This is the necessary mechanism needed to control and work with the digital certificates in a manner that will foster a digital environment capable of establishing authentication and trust.

The CA will be used to carry out a number of distinct functions. Primarily these will be used for managing digital certificates, including issuing and revocation. Also, included would be functionality that can be used to authenticate ones identity. For better understanding, the operation of a CA will be illustrated through the use of an example centered on the distribution of music.

The discussion will start from the point where a customer has found their music selection and has chosen to make a purchase. With a business solution based on certificates, a customer would first be required to establish an electronic identity. There are numerous ways for this to be accomplished. In this case, assumptions will be made that the music distributor will be acting on

its own behalf and not requiring the use of a third party that would perform the functions of a CA. With that said, the customer may acquire their electronic identity via a registration process conducted through the distributors online storefront. Once the customer has completed the registration process and is "signed up", he/she will be given their electronic identity, i.e. digital certificate, based on the information the customer provided. The convenience of setting up the customer in this manner is that, for the most part, the process can be automated. This would alleviate the need for the customer to be familiar with the intricacies of a system based on digital certificates. Now that the proper credentials are in place it is time for the system to be used for establishing identity and trust. For example, a customer would first make a request for a music file purchase. The distributor receiving the request would then request the customer's digital certificate. The customer's user interface (this could be an application that resides on the equipment the customer uses to access music) would then forward the associated digital certificate, containing all the necessary information. With the customer's certificate in hand, the distributor will be able to gain more insight into the customer's identity. First, by decrypting the message with the customer's public key they know that the owner of the associated key pair would have been the one to generate the message. Second, the distributor will be able to extrapolate the additional pieces of identification information. Finally, since the distributor has acted as its own CA, its digital signature should also be included with in the customer's certificate. This adds an additional level of certainty that the customer is certificate is trustworthy. Conversely, if this validity check revealed that the customer was not registered and could not be identified, they could be directed to a registration form where the process would pick up from the beginning. With this complete a transfer of music may now be able to commence.

The discussions above illustrated the general use of digital certificates as it may apply to the music industry. Much of the same functionality and technologies are incorporated in the next topic of discussion. The reason for special attention to the following technology is due to the fact that it has gained a great deal of industry acceptance. [35]

## VII.E.

Secure Socket Layer (SSL)/Transport Layer Security (TLS) further boosts the functionality of digital certificates. This is accomplished by taking what digital certificates offer one step further. By providing a convenient platform on which the music industry can construct their online existence. Furthermore, SSL/TLS brings to the table a solution that is readily available. This makes it convenient for the music industry because they could either fully adopt or construct a solution based on this technology that meets their needs, without the need to reinvent the wheel. Another factor making SSL/TLS an attractive alternative is that there is already a wide distribution of applications that utilize this technology. Many contemporary web browsers, such as Microsoft's Internet Explorer and Netscape's Browser have SSL/TLS compatibility built into their applications. With that said it's easy to appreciate the viability of this technology as a solution for the sales of music over the Internet. Moreover, music distributors, for the most part, will not have to be as concerned with making sure their customers have the required technology to listen. With the use of applications already tailored for SSL/TLS it would be a matter of tapping into what is already available. The examples mentioned above, Microsoft and Netscape browsers, as well as many other applications, are well suited for meeting these requirements.

Since SSL/TLS is founded on the use of digital certificates many of the same operational characteristics will apply. Most of the details behind digital certificates, digital signatures and



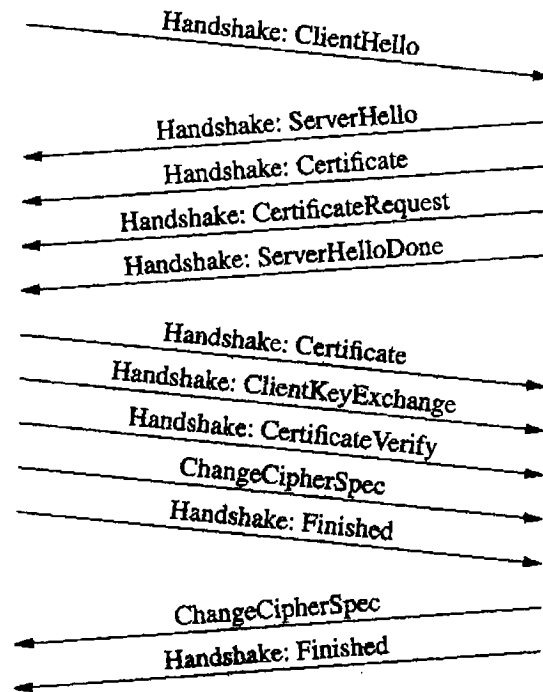
asymmetric cryptography have been left out of this section. There are, however, a few subtle differences and additions that will be expanded upon. SSL/TLS is a multi functional technology that can be applied in a variety of environments. The following examination of SSL/TLS will concentrate on how the music industry can use this technology to support their business objectives. The remainder of this section will take a look at how SSL/TLS can be used to establish a secure channel of communications between customers and their music vendor. Also included will be some details on how SSL/TLS can be used to acquire client or customer authentication.

The handshake involves a sophisticated process where both ends of the communications channel first agree upon the set of encryption algorithms that will be used in subsequent communications. Each side will then create and share their encryption key information. With this information in hand both sides will be poised to securely communicate with one another. Once this has been accomplished the system is ready to exchange identification information. A typically SSL/TLS implementation is used for server side authentication. This may work fine in situations where the customer is concerned with being assured of the identity of whom they are communicating, such as in a banking scenario. For instance, when a customer connects to their online banking institution they would like to know that they are truly dealing with their bank, and not some other entity. Conversely, the music industry may desire to use SSL/TLS in a non-traditional sense where they would rather authenticate their customers. Take for example a case where a customer signs up for an online music subscription service. The music service provider may feel the need to implement some measure of access control. Systems based on the SSL/TLS implementation of client side authentication could then be use. Customers will only be permitted

to enter the service only if they can be authenticated as being paying customers. Client side authentication, which is a multi step process, is explored next.

It's important to note that all client authentication requests originate from the server. When a music distributor, acting as the server, wants to verify a customer's identity they would first request verification from the client. The server would send, to the client application, an initial message known as the "CertificateRequest". Refer to **Figure 8** below for a pictorial representation of this process. The client then responds with a "CertificateVerify" message sent back to the server. This would include both the servers' original "CertificateRequest" and its own "CertificateVerify" messages within a new message. Before sending, the client encrypts the message with the private key associated with the digital certificate it is sending. The server will then be able to use this information to prove the identity of the client. This is made possible because the server has both the clients public key, which it uses to decrypt the "Certificate" message, and the original "CertificateRequest" that the server originally sent to the client. Again this allows the music distributor to gain a level of certainty that they are dealing with a legitimate customer. Furthermore, appropriate customer access permission may be applied in accordance with the results of the authenticity verification. Along with these technologies there are a variety of others that can be used to support the music industries overall object. [36]

Figure 8



Courtesy – Eric Rescorla, SSL & TLS Designing and Building Secure Systems

## VI.F.

There are quite a few other technologies and/or techniques being developed that would support an overall DRM solution for the music industry. For example, internal clocks built into consumer devices will be able to support a variety of time sensitive controls on content. These may include free promotional samples or business models based on the “super-distribution” (more on this later) of songs to be permitted and controlled by the time element. This means that the music files will be free to roam the Internet but will “self-destruct” after a predefined expiration dictated by the content owners. The realm of possibilities seems to only be limited by the imaginations of those creating the technologies of DRM and how they can be best utilized.

Augmenting technologies, much like embedded clocks, will make available a wide range of other techniques that the music industry can use to support the online sales of music content.

Another such technique is postprocessing. This is a practice where the data is rendered useless once specific conditions are met. For example, a customer buys and downloads a music file. Suppose the customer purchased the rights to play the song as much as he/she desires. Postprocessing enters into the picture when any condition, other than those previously agreed upon, reveals itself. In other words, if that customer attempts to copy or pass on a music file without permission, it will be "postprocessed" into a form that is unusable. Again, this technique could be based on any combination of the technologies discussed thus far. There are other advancements that could be coupled with some of the technologies previously discussed. One worth mentioning related to the identification. [37]

Hardware-based identification systems provide an alternative, or add onto, those discussed in the digital certificate and SSL/TLS sections found above. Systems based on this type of technology are better suited to devices or applications that are dedicated to the function of playing music players. This is because the same unit will typically always be used to play music. The identifiable piece of information will stay resident to any given device. This gives the system a more reliable piece of information to use in the identification of customers. Associating this unique identity can then be associated with both the device used to listen to music and the customer. Intel, for example, has been deploying identifiable features into its technology in the form of an embedded Processor Serial Number (PSN). This unique number identification has been built into a wide range of Central Processing Units (CPU), since the appearance of the Pentium III, and likewise has made it into a variety of consumer devices. With these resources, it is hoped that trust relationships may be established based solely on

hardware identification. This is accomplished when the association is made between an identification number, such as the PSN hardware number, and the user of that particular device. Coupling use of hardware-based identifications with technologies based on digital certificates will further add to the overall effectiveness of a DRM enabled business initiative. As one may be able to see, there is quite an array of technologies and techniques for use in DRM. Before the use of these can be effective, though, implementers and users of DRM should consider some of the adverse issues related to DRM. It is not simply the application of these technologies, but rather a full understanding of these technologies and how they can be best applied to the overall DRM solution that will pave the way for success. [38]

One such system is a proprietary solution based on technologies and methodologies developed by the individual organizations themselves. A DRM system based on proprietary solutions would utilize "non-standard" means of encoding, distributing and rights assignment techniques, leading to brand specific solutions. Such systems could use any combination of the technologies discussed above or could be based entirely on proprietary technologies. Adopting this type of solution may prove to backfire as the industry moves forward with using DRM and creating an online existence. The nature of how people listen to their music purchases will have to be based on a seamless, unhindered, and interoperable environment. This will only result from compatibility of the DRM solutions used.

## **Pitfalls of DRM:**

### **VIII.A.**

As with anything else, the DRM movement is not without consequences or issues that could adversely affect its outcome. There are a number of questions that surround DRM's

viability, which will need to be understood and overcome in order for it to become a success. A few of these are looked at next. These are not being presented as though they will be showstoppers, but rather to enlighten the reader. With any luck, this will help pave the way for a successful deployment of a DRM solution that the music industry could capitalize on.

The first issue relates to the sheer complexity of such a system. Each of the above technologies is graced with its own unique intricacies and problems. Compounding this is the fact that many DRM solutions will require a combination of these technologies, working hand-in-hand towards the final goal. This is unavoidable. But it will be imperative that the implementation of DRM be streamlined as much as possible. First and foremost, a potential customer should not be aware of the complexities behind the system that they are about to utilize. If these systems are allowed to become too cumbersome, the potential exists for customers to be driven away rather than attracted to the service. Not only will the underpinning technologies of DRM add to its complexity, but also the variety of individual players involved who are developing a wide range of their own implementations.

## VIII.B.

Standards that are based on proprietary solutions rather than open source, will also contribute to the complexity of a DRM system. All involved are striving to reach uniqueness in their product, possibly to gain a competitive edge. By doing so, it is foreseeable that a number of different standards will be adopted. This will stifle interoperability and may result in turning away a large population of customers. For example, a common file format has not yet been adopted. There is the all-too-familiar MP3 file, but on the same token, there are several proprietary formats also in consideration. Examples of these are Microsoft with Windows Media Format (WMA), Lucent with their Perceptual Audio Coder (EPAC) and another referred to as

Advanced Audio Coding (AAC) [39]. If interoperability is not designed into DRM systems, it will make it very difficult for customers to enjoy a wide range of entertainment. Suppose that you purchase a compilation of digital music files from an online distributor called Company A. Company A uses the WMA file format for their music format. You then decide that you would like to purchase another compilation, but this one is only available from Company B using the EPAC format. All this while you have purchased a media player that only supports MP3. If this is allowed to occur, many customers will be driven away, especially if they are required to obtain a different set of resources to play their music. It will be very important for the music industry to follow standards by which all involved can apply their DRM offerings.

#### VIII.C.

There are also many more issues that can be categorized under human factors that will need to be considered as DRM is implemented. The first of these to be overcome will be the lack of a sense of ownership. Customers have become accustomed to receiving tangible goods when making a purchase. This is especially true with entertainment received in the form of a CD. When a purchase like this is made, the customer receives something that can be handled. Conversely, receiving music content in a music file, will not. Unlike a CD, where one could listen to it wherever and whenever the desire hits, music provided under a DRM solution would have controls that will dictate the allowable usage of the music purchased. Furthermore, this lack of a feel of ownership would be further compounded if a DRM system restricts customers from copying their purchases to CD. This brings us back to issues related to fair-use rights. [40]

Much like the DMCA, discussed in Part 1, it is foreseeable that DRM may also jeopardize fair-use provisions permitted under pre-existing copyright law. As with the CD example illustrated above, customers may lose a number of their fair-use rights. Along with the

ownership of a physical CD came a few privileges, which up until DRM, may have been taken for granted. For example, one could elect to give the CD to someone else to borrow, as a gift or once they grow tired of it. There was always the option to sell their original copy as well. Likewise, copying the music CD for their personal use was permitted by both the old copyright laws as-well-as CD technology. All of these provisions could eventually erode under the auspice of DRM. Adopters of DRM should give equal consideration to the needs of their customers, notably convenience and flexibility. [41]

Another of the human factors that will need to be understood is the notion that DRM may be opening the doors for abuse and will cause the "Big Brother" effect. Many of the proposed DRM solutions will have built-in channels for data collection and reporting. The intentions of this information will be to provide a mechanism through which marketing can take on a more active role. For example, if this information shows that a particular customer listens to Blue Grass music, special initiative could be presented to the customer or purchasing similar or other genres. Another way this information could be utilized is by identifying market trends; an appropriate business plan could be adopted. Whatever the case may be it shouldn't be surprising that this has become one of the biggest issues related to DRM. Privacy advocates are very aware of the marketing potential of DRM; however they also see cause for concern. It is believed that the collection of this personal information could result in "price discrimination". This is a situation where one customer may be charged a higher rate than another based on their individual likelihood to make a purchase and/or their demographic profile. Another facet for consideration is that some of these DRM systems will, in order to work, require special hardware and/or software to reside on the customers' equipment. Accepting such a notion would also be



accepting some loss of control over their personally owned equipment. This is most evident with technologies like the embedded PSN, discussed section VI.F above. [42]

#### VIII.D.

Encryption technologies are also a point of contention. One of the potential problems with building a DRM system on cryptography is that there will always be attempts to break the encryption algorithms. None of the algorithms in use today are immune to this danger and it is only a matter of time and effort until they are compromised. Obviously if this is accomplished DRM systems based on those system particular encryption technologies may prove to be worthless.

Another hurdle to overcome, and one related to digital certificates, will be the challenges associated with key management. These challenges arise due to the volume of customers. Each customer will require their own certificate, with each consisting of several unique pieces of information. This will result in a very large amount of information that will need to be managed. In addition to this, systems based on digital certificates will also need to address issues related to issuing, recovering and the revocation certificates. Without these functions a systems based on digital certificates will prove to be useless. [43]

#### VIII.E.

Legislation will also be a factor and may impact the outcome of DRM. Recall that the DMCA discussed in Part 1 is responsible for restricting scientific research as it applies to the circumvention of protection technologies. The DMCA will have an adverse effect by making it more difficult, if not impossible, to conduct sound research into encryption and watermarking technologies. Sure, the organizations that develop these technologies could foreseeable conduct their own research; however it would not be as extensive as university level research or research

conducted by an institution specifically challenged with investigating the possible vulnerabilities of the specific technologies.

#### VIII.F.

One final note deals with threats that these technologies themselves are faced with. Unlike circumvention techniques of the past, if any of these technologies are compromised, the system as a whole may become worthless. Prior to online digital media, the threats to copyright infringement were usually isolated to a local community squelched by physical limitations. In the online realm, if any of the technologies of DRM were compromised the consequences could be detrimental. The methodologies for skirting the DRM system could be rapidly distributed throughout the Internet community. This would result in the failure of the DRM system. With that said, it is imperative that the implementations of DRM be based on sound technological deployment and business models. The success that DRM can bring the music industry is dependent on overcoming these issues.

The remainder of the page intentionally left blank.

## **Part 3:**

# **CONSTRUCTING A BUSINESS MODEL WITH DRM**

## **Paving the way for DRM:**

### **IX.A.**

With an understanding of the technologies best suited to protect the music industry's copyright interests it is time to address the business implications. Specifically, how will these technologies be used to support a variety of business plans geared toward the online sales of music. It should be noted, though, that before DRM can become mainstream, there are several areas where it will need to mature to a point where it could be fully effective. Taking a higher-level look at the DRM picture, it becomes clear that the infrastructures needed to enable and support the use of DRM will need to come into existence or at the very least will need to evolve to meet the requirements of the DRM technologies. This includes examples such as the underpinning systems needed to establish trust relationships as well as DRM compatible consumer electronics that will support the assortment of business initiatives. It is not sufficient for technology itself to support a business plan alone, but rather the combination of the technologies, supporting systems and sound business plans which will be required. To date, much of this development is rapidly occurring and the industry as a whole is fast approaching the point where a DRM enabled environment will become a reality.

Specifically speaking, there are three areas where this growth must take place. Included are: trusted environments, standard rights modeling languages and trusted players [44]. Infrastructures based on, and built around these technologies must be put into place. In some cases, such as SSL/TLS, the technology is already distributed and readily available for use. It's

simply a matter of adapting a business plan around the use of such technologies. Also, in order to utilize trust relationships within a business plan a supporting infrastructure will require deployment and tailored to meet the music industry's requirements. Furthermore, DRM enabled consumer electronics for purposes of music playing, either hardware or software based solutions, have to emerge and be made available to the scores of targeted customers. In order for the full power of DRM to be harnessed, many of these requirements will need to be resolved. One of the greatest forces behind this notion is the ratification and adoption of agreed upon standards. It will be standardization that brings the industry together in support of a common goal that is needed if DRM is to be used as a viable and successful business tool.

#### IX.B.

Standardization will be perhaps one of the greatest impacting elements to the success of the music industry's use of DRM. While many of the players in the online music distribution space would like to create a business model where customers are locked into their particular offerings, this will be undesirable to the customer and may prove to be devastating to the hopes and dreams of a DRM enabled online existence. This is due in part to the possibility that customers will have a wide range of listening interests that span across several of the players in the industry. For example, BMG (one of the "Big 5" record labels) has an album that interests you and one of the other labels has another that is found to be equally appealing. For the customer to be fully satisfied with the digital music experience, he/she should be not be aware of who holds the keys to the kingdom. They would simply like to enjoy their purchase in an unencumbered manner. The deployment of DRM must facilitate this need to allow customers the freedom to explore and make purchases across many, if not all, points of music distribution. This has certainly been the case in some corners of the industry as many steps that are being

taken have illustrated that there has been a growing awareness of these needs. Evidence of this can be seen through several strategic alliances that are developing between music industry players and the emergence of supporting standardizing organizations.

Examples of this can be seen through consortiums being pushed by organizations such as GartnerG2 that are specific to the music industry itself. GartnerG2 was developed out of the obvious need to get all involved in the creation, production and distribution of music to work collaboratively toward a common structure for protecting digital music. These parties would encompass the Big 5 record labels (BMG, EMI, Universal, Sony and Warner Music), the Recording Industry Association of America (RIAA) and developers of DRM technologies. GartnerG2 realized this need early on and since then has made this point clear. What they have stressed is that it is imperative for agreements to be made and, though some are rivals, all parties involved must work together for the betterment of the business objectives. [45]

Another such example is the Secure Digital Music Initiative (SDMI). This is an organization comprised of many of the same participants as outlined in GartnerG2. A quick visit to their web site, <http://www.sdmi.org>, reveals the charter under which they operate, see **Table**

**Table 5 – SDMI Charter**

1. Provide consumers with convenient access to music both online and in new emerging digital distribution systems.
2. Enable copyright protection for artists' works.
3. Promote the development of new music-related business and technologies.

Courtesy - SDMI

5, for the three primary goals [46]. All organizations that are members of the consortium of industry players will be involved with the standardizing process. What's more, those parties who develop and/or use SDMI compliant devices can rest assured that a certain level of industry acceptance could be achieved.

Receiving special attention are mobile devices. The underlying need is perhaps most notably due to the mobile nature of those who listen to music. The Open Mobile Alliance (OMA) was formed for the very same reasons as those presented in the previous two examples, though obviously tailored only to mobile devices [48]. This step is strategically important on many levels. First, while the mobile device development is in its infancy, when compared to other technologies such as the PC, it has come at an opportunistic time to consider the new technology. Developing standards and shaping these devices at an early stage will result in a better product in the end. Second, considering the vast array of mobile devices that are available, it should be no surprise that development and ratification of standards will have a profound impact on it's utility as a DRM supporting device.

Both Gartner2 and SDMI are examples of organizations that have emerged in an attempt to address issues related to building strategic alliances and standardization within the digital music realm. This is only the tip of the iceberg as there are many other organizations with farther reaching goals as it applies DRM. Refer to the Reference section at the end of this paper for more information. It can be said, though, that there is an obvious need for standardization and it is gaining industry support, driven by the common goal of a seamless and lucrative adoption of a DRM solution.

## IX.C.

With the availability of the technologies under the DRM umbrella, the supporting infrastructure and standards for engagement are in place creating an environment where the music industry will be poised to take advantage of the powers presented. Technology has lead to a new frontier for conducting commerce, DRM will take it one step further by providing the necessary intellectual property protection needed in an open environment such as the Internet. With that said, the music industry will be confronted with many lucrative business opportunities and will be able to capitalize on technological advancements.

The remainder of this paper will focus on the benefits gained though the use of DRM (both to the industry itself and the customer) and how an online existence can be structured to take advantage of these opportunities while supporting online sales. Finally, consideration of current events will also be presented with an exploration into some of what is now being offered online. This will give you a taste for what the future of online music sales may look like. The opportunities are endless and will only serve to drive the industry to employ DRM.

## **Building a Business Platform on DRM:**

### X.A.

There are a variety of business models that can be adopted by the music industry that will support a rich environment for the online sales of digital music products. Many are based off of tried and true methods while others are emerging out of new and inventive ideas. Capitalizing on the added technological functionality of the Internet and DRM brought about these methods. One such model is based on the Business-to-Customer (B2C) concept. Under this scenario, music can be sold directly through digital storefronts. Record labels, retail distributors, artists or

any combination of these can offer their music information goods directly to potential customers. As a result of B2C transactions, the industry will be able to all-but-eliminate the middleman, still required in conventional transactions. This will lead to the variety of cost savings measures as discussed above.

Another way to look at the B2C concept is through the musician's eyes. The Internet presents new and powerful tools that artists can use to self-promote and distribute their music directly to their listeners. As the O.A.R. example from earlier illustrated, artists are no longer bound by the need to utilize the resources of record producers and distributors. Although the argument can be made that for a select few this is an invaluable resource. This has aided in the successes of several musicians who have not been "discovered" through traditional means. By independently building an audience, the undiscovered band stands a better chance of distributing their material and building a fan base. What's more is that if successful at appealing to a large populous of listeners the band may draw the attention and of one of the major record labels possibly leading to signing a contract.

Clearinghouses can be used as an alternative interface to music shopping. Rather than each individual label or retail outlet offering confined list of music titles, a common entity could offer a wider collection of music. This is where the clearinghouse comes into play. A clearinghouse could act as a central repository for anyone who desires to sell music through online resources. Both the music product from artists and/or those promoted through record labels could be distributed through these means. The clearinghouse would then make available the music content from a larger collection of resources. This would give customers a single point of contact for their music, which is essential when considering the variety of record labels and retail outlets that are available. Again, the customer would also benefit by reducing the need to



search for their music across a wide range of resources. Another effect of DRM could be the legitimization of other alternatives that are traditionally thought to be harmful to the business model of the music industry.

## X.B.

Unlike the common notion that P2P networks are a serious risk to the interests of the music industry, it is possible that DRM proves this notion to be quite contradictory to those beliefs. DRM technologies, such as the digital watermark, have enabled usage control rules to be integrated with the music content itself. Therefore, the music product is a combination of both the content and the information needed to dictate allowable usage permissions. Separating the music from this acceptable use information would only serve to destroy the desired commodity...music. With the use of these technologies the door has begun to open for the super-distributed concept to come into play and a wider acceptance from artists, vendor and distributors. It is with this approach that the music industry will become more

Accepting of the Internet as being a viable business vehicle The common belief that music file swapping and P2P distributed music file sharing is harmful would all but evaporate. The key here is that the music is self-protecting as described above.

Adding to this is the concept that DRM has empowered copyright owners with a variety of flexible options for placing controls on their music. An example of this can be seen through time constraints that can be used to control music files. Owners of music may choose to allow anyone to listen to an un-purchased piece of music a given number of times. Once this number has been reached, the music will be disabled until an appropriate purchase is made. Scenarios such as this serve two purposes. First, by allowing someone the right to sample a piece of music will create a try-before-you-buy scenario, hopefully giving potential customers more incentive to

make a purchase. Secondly, listeners of music now become a new marketing tool by allowing them to pass on music content onto other customers. Again, through the adoption of both DRM technologies and the super-distribution concept, the music industry has been able to allow open availability of their music, while at the same time assuring that their copyright ownership is preserved. This is only one example of the different types of business models that can be established. There are a variety of other creative new sales strategies that have and continue to be developed and integrated into the overall product line.

#### X.C.

Another viable solution would be based on a subscription model. Rather than purchasing individual or collections of music files, customers can be given the option to buy a subscription to a service instead. The terms and conditions of the subscription agreement could be setup to meet a variety of criteria. Music providers could offer a suite of different services with complementary levels of subscription packages. For example, a customer could be presented with a “base option” of any particular music genre for a given monthly charge. That customer would have limited access to listen to the music feed to their compatible music playing devices. Additional levels of service can be offered at higher costs but with added usage rights. These may include a wider selection of music or perhaps permissions to download a specific number of music files. This, obviously, would come at an increased cost over the base subscription to the customer. Moreover, tiered levels of subscription-based models could be made to offer a wide range of options that customers may choose among. Customers who enjoy staying informed on current events and/or prefer to have exclusive access to articles related to their favorite musicians, can be offered this information as an a la carte option to standard selections. The subscription model makes an alternative means of providing music available to customers. This

model for conducting business carries with it several advantage and disadvantages over other means of gaining access to music.

Subscription based services are a viable alternative from the standpoint that listeners will be able to gain access to a greater breadth of music at a lower per unit price. Typically, the costs of music will be less due to the fact that customers will be giving up some of their individual control over how they will be able to use the purchased music. Subscription based modes of operation will restrict the amount of music that customers will be able to listen to or download. DRM can be used to control music to the extent that customers may be restricted to listening to a particular unit of music a limited number of times. The disadvantage will be that customers run the risk of losing control over what music is received and possibly the inability to amass their personal collections. Subscription based online business will not work if the only choice a customer has is among a few artists and across a limited range of genres. Depending on how one looks at it, another concern with subscription-based offering is related to a situation where customers become locked into a particular offering. Looking at it from the industry's viewpoint, though, the industry will gain through the establishment of a sustainable customer base. This business model will lead to a perpetual source of income for the music industry. In order to overcome some of these issues it will be imperative for customers to be presented with a wide range of selections with the added ability for them to individually tailor their preferences. Customers can be given some level of actual, or at least perceived control over their purchases.

X.D.

Choiceboards are yet another alternative that could be explored. An online existence allows for a variety of new business practices to be implemented with regard to customer choice. It's no secret that customers would rather have a choice when it comes to tailoring their

individual purchases. Unlike a traditional music store where a customer enters and weeds through case after case of records, cassettes or CDs, the online storefront can be much more accommodating to the needs and desires of a prospective customer. Choiceboards can be used to build an interactive relationship with customers. This new interactivity will result in giving them a sense of control over their experience. Furthermore, setting up and utilizing this functionality will make browsing and locating music much easier. Hopefully contributing to the satisfaction of the customer.

One such option will include the possibility of giving paying customers the ability to create custom designed music CDs based on their individual music tastes, this is already evident through many of the emerging online music stores, more on this later. Say for example the online music store offers low quality samples of music for try-before-you-buy purposes. A customer browses through the collection adding their selections to a “burn bin” as they locate a favorable piece of music. Once the customer’s “burn bin” is full and an appropriate purchase is made, the content of the bin can be downloaded and burnt to disk via the local CD-R/W drive. This obviously shifts the music product pyramid. What the customer gains is a collection of music that is of the quality and selection desired. This eliminates the risk of buying a CD only to find that there are just one or two good songs. This is obviously advantageous for the customer but what about the music industry in general?

There are many solutions that can prove to be mutually beneficial to both customers and the industry alike. A combination of some of the services discussed thus far can lead to such solutions. One example of this may be the combination of the choiceboard with offerings provided under the subscription-based model. Companies could offer a subscription services while also giving customers additional options. This follows suite with what cable companies

already offer. Customers subscribe for a base service while also being offered additional services such as pay-per-view. What this does for the music industry is allows then to command an additional cost over baseline options. It would be foreseeable for offerings such as theses to carry an elevated price over more traditional purchases due to the extra privileges gained. Customers may be persuaded into paying a little more for music if they know that the product received will be a satisfactory purchase.

## X.E.

There will be a multitude of other business schemes that will be explored through a DRM enabled online existence. Many of these will come in the form of advertisements and other marketing practices. As was discussed in the technology section of this paper, the digital watermark will once again prove to be a powerful tool at the music industry's disposal. Having the ability to forward additional information along with the music itself will have far reaching implications. The desired outcome of taking such actions would be the generation of additional sales. A short discussion on some of the ways that this additional information can be used will follow.

Promotional and advertising information, for example, could be included with the sales of a music file. This could encompass information about upcoming album releases, concert dates (with links to ticket offices) or motivational techniques such as coupons. New and innovative ways of generating sales can also be explored. For example, a song could be broken up into five separate pieces. Each piece could be included with an individual music purchase. After the fifth song has been bought the customer is essentially given a sixth song for free. The result is that the customer is given extra incentive to make five purchases where only one may have otherwise occurred. These could also be accompanied by price breaks handed out to individuals who

purchase a concert ticket in conjunction with music. Other types of incentives can also be explored.

Tying free samples in with marketing promotions and/or incentives will add yet another level to what can be offered to online customers. Providing a potential customer a “taste” for the product may persuade them toward other purchases. The online storefront could give customers the opportunity to listen low quality or partial recordings of the music to be sold. Try-before-you-buy will enhance the purchasing experience by using these tools to educate and inform customers. This would hopefully enrich a customer's knowledge of music, thus boosting their desire to explore other alternatives. The goal to customer education is making them aware of the different styles of music and a variety of artists. This could trigger customers into making lateral purchases, otherwise not achieved. For the music industry, this creates a customer base with a wider range of listening habits and interests. Providing these samples could open the doors to a newly discovered interest in other areas of music, which the customer may not have otherwise been aware of their existence.

Music content providers would also be poised to explore new potential sales. Bundling music with lyrics, pictures of the artists or biographies could be offered at slightly higher prices. Just about any type of information could be added to the music purchase, either to generate additional sales or to simply enhance the experience. For example, other types of media content could accompany a music purchase, such as movie clips. This may provide customers with a newfound awareness of what else is available. Contracted advertising revenues could also be collected by the music industry, which could provide some level of subsidizing the costs associated with producing music. What can be said is that the options seem to be endless. It is hoped that more sales will be made in addition to giving the appearance that a customer is

gaining more from each dollar spent. From a business perspective the idea behind these optional schemes are that customers will be presented with information that either educates or provides incentive to make additional purchases.

## **Taking Advantage of Presented Opportunities:**

### **XI.A.**

As has been stressed, the business opportunities brought about by Internet sales of music are potentially plentiful. There is a wide range of contributing factors that will benefit the industry as a whole. Artists, record labels, vendors and those that distribute music are positioned to gain a great deal from conducting business over the Internet. Furthermore, the music industry will increasingly find that DRM will be the utility that is beginning to make it a viable alternative. The first and obvious area where an online-based music market will benefit will be through cost savings. Once again the PricewaterhouseCoopers Entertainment and Media Outlook 2003-2007 reported that this has and would continue to happen; the use of the Internet will compound the saving therefore driving prices down even further through the decrease of production and distribution costs associated with prepackaged CD products. Neither of these will be necessary in the online environment. The product will be delivered directly to the customer where he/she can then store and use their purchases on a variety of consumer products. In the end these savings will result in higher profit margins hopefully resulting in more sales and with the added incentive of passing a portion of those savings onto the customer.

Other savings will come in the form of reductions in the overproduction or underproduction of a music product, a major advantage.. Warehouse spaces will all but be eliminated, as there is no longer the need to store all of those albums. Conversely, nor will

customers be driven away when the product is not available. The best time to make a sale is when a potential customer has made up their mind on a certain purchase. If the product is not available for their immediate consumption, there is a possibility of losing that customer. Customers will typically find some other means to get what they want, i.e. they may make an alternate purchase, or they may use file swapping networks such as Kazaa. Not only will the Internet bring about savings associated with the reduction of overhead associated with the physical product, but the vast "reach" of the Internet will also play an important part. [48]

Reaching a wider range and a globally distributed audience (minus any government imposed statutes that prohibit such traffic) is possible. Having an online existence has expanded the customer base to a global scale, ending geographic isolation. The music industry has at its disposal the ability to reach customers anywhere and at anytime. This results in a much larger customer base than what was previously known through physical means of music distribution. Furthermore, file-swapping networks have demonstrated the potential behind maintaining an online existence. It is with DRM that the music industry has begun to harness the power of the Internet, and the file-swapping phenomenon, while also preserving their interest. Greater acceptance will only server to make more options available to customers. This expands the market to online distribution of music that will satisfy the needs of the music fan while also providing some benefits to the industry as well.

## XI.B.

Though the theme of this paper may seem to indicate that the music industry will be the only beneficiary of DRM, this couldn't be further from the truth. There are several cases where customers have and will continue to win though the proper use of DRM. This is evident with online merchants such as Apple's iTunes (more on this later). These types of operations would



not have been possible without the use of DRM technologies. Customers are given the added convenience of searching for and browsing through electronic catalogues of music. As the iTunes example will illustrate these offerings will make the experience easier and less time consuming. What is eliminated is the need to spend time traveling to a music store and manually searching for one's selection, which is necessary when dealing with a brick-and-mortar establishment. These will also serve as a one-stop shop. As the use of DRM becomes more of a mainstay and industry acceptance grows operations such as iTunes will be able to further expand what they offer. Furthermore, customers will no longer have to wait for new releases to be delivered to their local music stores. Music, new and old will be readily available for purchase.

Interestingly enough the scenarios presented above will prove to drive down prices. This through the realization of reductions or the elimination of cost associated with unnecessary overhead. Again this will result from the downturn in the need for production and distribution methods needed under the old business model. The need to produce and deliver a physical product is all but diminished with the use of the Internet as a distribution point. Again, it is DRM that makes the Internet viable to the music industry as a vending tool. For example, as we have seen with the example above, customers, can be given, through DRM, appropriate permissions that allow them a level of control over their purchases. These include actions such as permitting paying customers to make a limited number of copies of their music. Permission also stipulate whether or not the music could be burnt onto CD-R or copied to a computer's hard drive and/or to portable devices for playback and storage. The online experience has shifted a customer's need for the purchase of prepackaged music CDs towards the digital equivalent. The music industry is in a position to capitalize on this by providing music at reduced cost to the

customer while at the same time using this to their benefit as well. The Internet could be mutually beneficial to both the industry and the customer alike.

These are not the only practices or business plans that could be adopted as a means to sell more music. Though not a direct consequence of using DRM it will be a part of the appeal for customers. Further augmenting the online experience are business-supporting functions, which are made to facilitate customer convenience. Provisions have been implemented that would embed billing functionality into the purchase cycle. Streamlining payment collection mechanisms can further draw customers and sales. For example, convenient billing solutions have been setup to automatically generate and/or collect funds once a customer has completed their music selections. Providing a seamless and painless digital music experience will serve to keep the customer satisfied. Furthermore, incorporating this rational into the business plan will only serve to draw in customers that would otherwise be turned away from online purchases. People are drawn to convenience and the Internet is no exception. If they find that less time is spent shopping online, they would be more inclined to pursue their purchases in such a fashion. Customers will generally return for additional purchases if satisfied with their experience.

One additional advantage brought about though DRM enabled online sale of music will be the number of choices presented to a customer. DRM will attract more interest from the industry therefore making more options available to the customer. Customers will gain a greater number of choices through this free flow of music ideas and listening options. A greater depth of music styles will be easier to find and acquire. This will serve to open up new realms of possibilities for listening pleasure. This has the potential of playing in the music industry's favor, as more sales could be generated.

## XI.C.

Not only will customers and major industry players benefit from these technologies, but also a few less obvious beneficiaries will surface. Artists themselves will also be able to take advantage of several opportunities otherwise unavailable without DRM managed music content. The online environment will allow for a greater number of artists to make their creations available to customers. Moreover, new and emerging artists will have a new promotional engine at their disposal that they can tap into. Some artists have bypassed the recording studios and record labels altogether and has gained in popularity and sales. An example of this can be seen with O.A.R., a young band out of Rockville, MD, that attributes much of their success to the distribution of their music across online sources such as the Napster's file-sharing network. To their surprise the Internet fostered their popularity, which eventually resulted in a number of the big labels taking notice [49].

## XI.D.

As previous discussions have alluded to, DRM can be used to control music in a number of different ways. Along with gaining copyright protection, DRM will facilitate the placement of stringent controls on digital music. These functions of DRM will drive the online business. Record labels, retailers, and artists alike will enjoy digital copyright protection while building robust and lucrative models for selling their music product. Furthermore, by employing the technologies and methodologies of DRM, the industry will be able to combat the ill effects of illicit activities, like P2P file sharing, and regain control.

DRM enables content owners to dictate who, when, how and through what channels their content can be used. These rules, therefore, dictate the allowable handling of music content [50].

**Table 6**, found below, outlines some of the elements that can be controlled [51]. Considering these rights and the ability to control these through DRM, one can begin to appreciate how the

**Table 6 – What can DRM control**

User Right	Description
Price	Cost of the information presented to the customer
Duration	Length of time customer may utilize the information
Frequency of use	Number of time customer can access the product
Rendering	The ability to save, copy, print, etc. the product
Transfer	The ability to send the product to someone or somewhere else

Courtesy – IDC

music industry has had the means to formulate their online marketing and sales initiatives. Moving forward, the music industry can strategically utilize the opportunities presented by DRM and begin to explore the variety of business options.

These underlining uses of DRM can be positioned and utilized in such a way as to lead the industry into a variety of business objectives. The music industry can employ these technologies in a fashion that enables the building of new and innovative business tactics, which can be tailored to best facilitate Internet sales of digital music. These opportunities will be explored in the ensuing discussions, followed by an examination of several examples of recent announcements and industry developments. This will show the current state of the industry as well as provide some level of future expectations.

## **Final Thoughts:**

### **XII.A.**

A recent study conducted by Screen Digest Limited suggests several shifts in what the music industry will look like in the years to come. These changes are a result of the impact technology has had on digitized music content and intellectual property. Refer to **Table 8**, found below, for a list of the areas where the music industry is expected to evolve [52].

**Table 7 – Music Industry Evolution**

<ul style="list-style-type: none"><li>• “The main currency of the record industry will be the song instead of the album.” This will force the record industry to adopt new, variable, demand-based pricing and adopt a new infrastructure for identifying the sale of individual tracks.”</li></ul>
<ul style="list-style-type: none"><li>• “Streaming subscription services which permit a consumer to access their music from any device anywhere will become the dominant way of delivering music. This will require technology that permits the consumer to be uniquely identified no matter where their access point.”</li></ul>
<ul style="list-style-type: none"><li>• “Internet users and music listeners are demographically similar. They are typically under 30 and the heaviest music buyers are flocking to the Internet to satisfy their music appetites. This makes illegal downloading a critical threat to the industry because it historically has derived most of its revenues from a small number of young, heavy music buyers.”</li></ul>
<ul style="list-style-type: none"><li>• “A handful of Internet mega music sites will emerge which provide subscription, community, e-commerce, information and other services beyond mere downloads or CD sales.”</li></ul>

Courtesy – Screen Digest Limited

The first conclusion of this study verifies what has been seen through the actions of music enthusiasts. P2P file sharing networks have shown that potential customers have a greater interest in the single file downloads rather than “spoon-fed” collections. Many feel that the album will be a thing of the past and that the individual song will be the new commodity. This new rationale can be attributed to the desire to obtain music that is of the quality they demand and expect. What's more, they want the flexibility and freedom to create their own compilations

and mix, into personal collections, music appropriate to their individual tastes. It's quite evident that what has been seen through the peer-to-peer file-swapping phenomenon, customers are no longer interested in prepackaged forms of music. DRM will provide the mechanism the music industry needs in order to formalize business models base on what the customer has shown they demand from P2P operations. That is the flexibility to choose the product that they individually desire. It will be the Internet through the use of DRM that the music industry will be able to meet these demands

The next shift on the list is that of digital streaming of music through subscription services. As the Screen Digest Limited list states, "technology that permits the consumer to be uniquely identified no matter where their access point" is an issue that will need to be resolved. This means that the identity of a customer must be able to be ascertained without regard to their location or the manner by which they choose to access the service. This requirement arises through the mobile nature of music customers. Enjoying music streamed to the radio in their automobiles, home stereo, PC or portable player devices will be essential. Facilitating this will be a number of DRM technologies, such identification systems. Delaying industry acceptance of this approach is the need for an infrastructure capable of supporting their use. Additional requirements would include the proliferation of compatible hardware and software. This will come in time as customers migrate to systems, software or devices that are built with these purposes in mind.

Also impacting the industry will be the realization of the relationship between music enthusiasts and those who are avid users of the Internet. This is a hard comparison to measure, but evidence seen through what the industry is currently struggling with, online file swapping, is foretelling enough. It is the emergence of digital rendering and the online music swapping

resources that have changed the demographics of the industry. In the article "Fans: Music Should Rock, Not Lock", by Brad King tells about Matthew Davidian's story. "With him, it's not so much about purchasing music as it is about choice. Mr. Davidian has shifted from purchasing music to using the free online service by MP3.com, chiefly due to new and creative styles of music options that are available. The music industry should listen to what he and many others demand. Otherwise, specifically combating ones customer base may prove to be detrimental. With this in mind it will be imperative for the music industry to keep their customers happy. That will require an online existence." [53]

The last of these projected shifts in business for the music industry will be related to what Screen Digest refers to as an Internet mega site. Merely opening up the doors to online access of music will be inefficient if wide ranges of music selections are not made available. Customers will need to be able to purchase music titles from an extensive list of those who produce music. Services will be ineffective if customers are required to shop for their music among several labels. This shift suggests that services will emerge which offer the music of several of the widely distributed music labels. These projections take this one step further and predict that these sites will also offer a host of services. This could satisfy every customer's taste and appetite for music, regardless if they desire downloads for burning onto CD or streaming of their music purchase. The point is, that customers have become aware of the convenience that comes with the Internet and will continue to require that their needs be satisfied.

## XII.B.

The industry has begun to take notice of this new shift and is beginning to move toward the Internet as a means to provide their content. Behind this drive is not only the realization of what customers are seeking, but also a comprehension of what this could mean for the music

industry. Forrester Research states that by 2007 online sales will account for 2.1 billion in sales, a 17 percent representation of the overall music industry's potential [54]. The past year has seen a great deal of movement in the way of strategic positioning in the direction of developing on online existence. Many of the big players are beginning to take notice of this potential and are evolving their product line for the online sales of music. One record label, Universal Music Group, last year began offering approximately 43,000 songs, via the Internet, for download. These downloads were made available through a number of different retail sites (refer to Appendix B for a complete listing of these retailers). Individual songs are priced at \$0.99 per track, with albums, averaging \$9.99. Included in Universal's collection of songs are artists like U2, Sheryl Crow, John Coltrane, The Who, and many of the more recently popular artists like 50 Cent and Eminem. Several options are available for listening to your purchased music. For instance, players such as Windows Media Player, Winamp, Musicmatch, Rioport Audio Manager, Liquid Audio Player, RealPlayer and others can be used to listen to music acquired through Universal. The only requirement is that the applications used will need to support the Windows Media Audio (WMA) format. In addition to this, their web site (<http://consumers.umusic.com/>) lists supported portable devices. Customers are presented with all associated information, from pricing to allowable usage permissions, on their interface to the music selection that they are investigating.

Referring to an actual selection, top of the next page, customers are presented with the pricing information of each music product as well as how they will be able to use and listen to their purchases. First notice that the CASH album is offered either as individual track purchases or as the entire compilation. Purchase of the album as a whole will come at a reduced cost as compared to individual songs. This provides some level of added incentive to buy the whole



collection. Although the option is available for those that find only a subset of the songs desirable and would rather make individual purchases. As an added incentive presented to customers, note that Universal has made it possible for prospective customers to sample the music prior to making a purchase.

The use of DRM becomes apparent with the information provided under the permissions column. Here, customers get a glimpse at how they will be able to use their purchases. As is illustrated in the example they will have some flexibility between writing to compatible CD-R devices and/or to portable players. It's also worth noting that not all artists follow this model. Madonna's new album, *American Life*, is only available as an entire collection of songs and not as individual downloads. Not to mention that the price for this album is a few dollars more. Universal is not the only one in this space making strides. There are many others offering similar services and options. [55]

EMI Group, for example, as of April 2003, has announced they will be opening up their online existence by initially providing up

**Liquid.com** give a digital music gift certificate! gift certificates: the perfect gift!

my account home shopping cart get player help

search:  Artist:  Genre:  Advanced Search Browse

Download music from The Man Comes Around

# CASH

Album: The Man Comes Around  
Artist: Johnny Cash  
Label: American Recordings  
Genre: Country  
[Buy this CD](#)

Tracks (Available in US only)

Song Name	Permissions	Preview	Time	Price	Get It!
1. The Man Comes Around			4:28	\$0.00	<input type="checkbox"/>
2. Hurt			3:36	\$0.00	<input type="checkbox"/>
3. Give My Love To Rose			3:27	\$0.00	<input type="checkbox"/>
4. Bridge Over Troubled Water			3:54	\$0.00	<input type="checkbox"/>
5. I Hung My Head			3:53	\$0.00	<input type="checkbox"/>
6. First Time Ever I Saw Your Face			3:52	\$0.00	<input type="checkbox"/>
7. Personal Jesus			3:19	\$0.00	<input type="checkbox"/>
8. In My Life			2:57	\$0.00	<input type="checkbox"/>
9. Sam Hall			2:30	\$0.00	<input type="checkbox"/>
10. Danny Boy			3:18	\$0.00	<input type="checkbox"/>
11. Desperado			3:12	\$0.00	<input type="checkbox"/>
12. I'm So Lonesome I Could Cry			3:02	\$0.00	<input type="checkbox"/>
13. Tear Stained Letter			3:39	\$0.00	<input type="checkbox"/>
14. Streets Of Laredo			3:32	\$0.00	<input type="checkbox"/>
15. We'll Meet Again			2:58	\$0.00	<input type="checkbox"/>

Windows Media [Add to Cart](#)

The Man Comes Around [Full Album Download] (Available in US only)

Song Name	Permissions	Preview	Time
1. The Man Comes Around			4:28
2. Hurt			3:36
3. Give My Love To Rose			3:27
4. Bridge Over Troubled Water			3:54
5. I Hung My Head			3:53
6. First Time Ever I Saw Your Face			3:52
7. Personal Jesus			3:19
8. In My Life			2:57
9. Sam Hall			2:30
10. Danny Boy			3:18
11. Desperado			3:12
12. I'm So Lonesome I Could Cry			3:02
13. Tear Stained Letter			3:39
14. Streets Of Laredo			3:32
15. We'll Meet Again			2:58

PRICE: \$9.95 [Add to Cart](#)

Legend

- Compatible to WM7-enabled and for Liquid enabled portable music players.
- Compatible to standard CD devices. For Liquid Player this includes any MMC compliant CD-R/RW device.
- Parental advisory explicit content.

powered by liquid audio

Important Notice: Windows Media Player's file sharing notice.  
Important Notice: Liquid Audio's files are not compatible with Windows OS.  
Home | Downloads | News | Contact | Privacy Policy | Terms of Service

©2003 Liquid Audio, Inc. All rights reserved. Liquid Audio is a registered trademark of Liquid Audio, Inc.

Courtesy – Liquid.com

to 140 000 songs for purchase. This was accomplished through agreements signed by more than 3 000 artists, to include some big names such as Norah Jones, Lenny Kravitz, The Beach Boys, Blondie, David Bowie, Nat King Cole, Deep Purple, Duran Duran and Pink Floyd to name a few. As EMI's announcement states customers will be able to "burn music onto CD-R, copy tracks to portable players, purchase singles online as soon as the songs are serviced to radio and in advance of their commercial release on CD". Just as with Universal there will be several retail outlets providing much of EMI's content, namely, Bestbuy.com, Musicnet on AOL, Pressplay and Listen.com's Rhapsody service. Pricing and available download options are on an even keel with Universal. [56]

Another sign of growing momentum is evident through offerings provided by Virgin Records, one of the labels under the EMI group. They are issuing the RADIOFREEVIRGIN music streaming service. This is a subscription based business model where customers can listen to music that is streamed to their media players. One of the requirements is that the customer will have to download and run their proprietary DRM solution, the Radio Free Virgin player. Built upon this is a two tiered subscription model. First, a standard solution that limits what a customer gets, but is free. Second, a paid solution, called Royal, where the customer has unlimited access and a host of other perks, see **Figure 9** for Virgins advertised subscription choices. The monthly cost of the later is set at \$4.95 per month. Additionally, Virgin offers a wide variety of artists however these selections are isolated only to their content and does not span a wide range of music titles. Coupling this with the fact that their player solution is proprietary in nature, customers will be limited in how and when they will be able to listen to the service. [57]

**Figure 9**

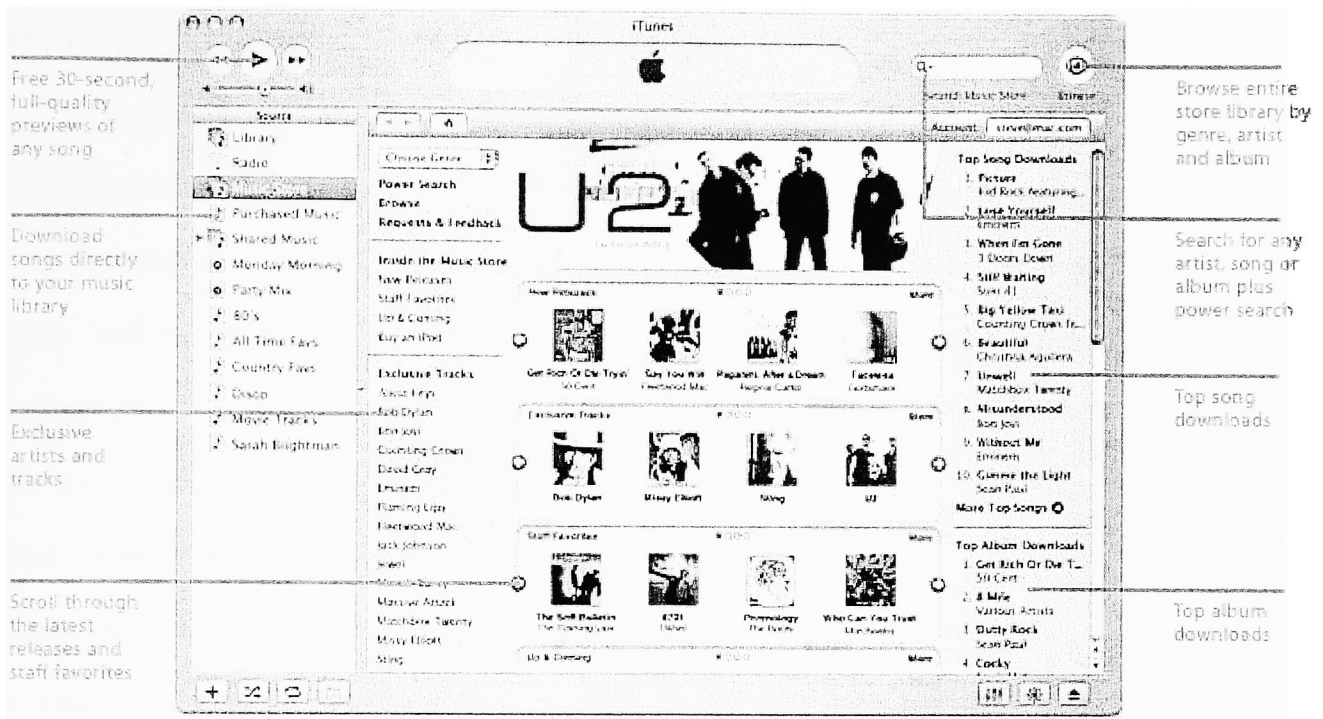
	<i>Royal</i>	Standard
True CD-Quality Stereo Sound	✓	NO
50+ Channels Of Incredible Music	✓	LIMITED
Exclusive Commercial-Free Channels	✓	NO
Audio Customization Tools	✓	NO
Song History	✓	NO
Favorites	✓	NO

Courtesy – Virgin RADIOFREEVIRGIN

Yet another approach is being offered through Apple. The iTunes Music Store, having recently been announced, offers some of the very same features and selections as those previously discussed. Alliances built with the top five music companies gives Apple a collection of 200 000 music titles that it will initially make available to customers. This number is rapidly changing in favor of the customer. Pricing for a single song download is comparable with both Liquid.com and Pressplay at 99 cents per track. What is unique about the iTunes Music Store is what the customer receives with their purchase. Restrictions are rather light, in that customers will be able to copy their purchased music onto three separate iPod devices (the iPod is Apple's portable music player solution). For more information on Apple's iPod refer to <http://www.apple.com/ipod/>. Furthermore, iTunes maintains a generous amount of permissions. As stated on their web site: "The iTunes Music Store is fast and convenient for you, and fair to the artists and record companies. In a nutshell, you can play your music on up to three computers, enjoy unlimited syncing with your iPods, burn unlimited CDs of individual songs, and burn unchanged play lists up to 10 times each." These restrictions seem to be a just and fair compromise to those who are making legitimate purchases. On the other hand, though, limitations will be noticed when customers choose to download music from the iTunes Music

Store. This arises due to the encoding format Apple chooses to use. They will rely on the Advanced Audio Codec (AAC) standard, which is part of QuickTime 6, also an Apple solution, for playing a variety of media types [58]. This issue may prove to be a source of resistance to some customers, as limitations will be placed on a customer's ability to listen to their music across a wide range of devices and/or applications. This will be resolved in the future with plans for a version of iTunes that is compatible with the Microsoft platform. On the plus side, though, is related to the reputation that Apple has with regard to user-friendly interfaces to technology. This can be seen in the qualities built into the interface encountered by customers with both the iPod music player device, as well as the online iTunes storefront. Both are exhibiting streamlined and intuitive interfaces resulting in making the experience of retrieving and listening to music easy and convenient. **Figure 10**, on the next page, shows the iTunes Music Store customer interface. Notice the many features that are available: free 30sec high quality samples, easily searchable catalogue, searches available by a number of different elements, and direct download to the customer's music library are all made available. This and the previously discussed examples show that the industry is exhibiting forward movement in the direction of making music available online, particularly through a variety of organizations that already have a strong Internet presence [59].

Figure 10



Courtesy – Apple iTunes Music Store

In the month that has passed since their original announcement, Apple's Music Store has experienced a tremendous amount of growth. Sales have reached numbers greater than 2 million purchases in that timeframe. Evidence enough that there is a market for pay-for-music sites, and that the industry as a whole is beginning to take notice of the potential the Internet possesses with regard to online sales of music. [60]

P2P file sharing networks are also showing that there is a movement toward going legit. Napster, whom everyone thought was gone, has made a return through asset acquisition. Roxio, a digital media software company, purchased the bankrupt Napster with plans of revitalizing the service. Their plans include both a monthly subscription service; in addition to offering

individual music downloads. It is hoped that legalization of this services will be achieved through deals made with the big five record labels. [61]

Other developments in the P2P world have seen AOL's re-release of MusicNet. AOL's desire is to take the P2P drive forward with legal offerings through MusicNet. A new service announcement states that they will provide on the order of 250 000 songs in their collection. Music will be available for download that customers will be permitted to burn to CD. Furthermore, AOL is taking a slightly different approach than what has been seen by other offerings. They are combining a subscription base service that permits music file downloads. Their solution maintains a tiered structure where, the more a customer is willing to pay per month, the more privileges they receive; **Table 8** below reveals this pricing structure, which can be found under MusicNet's business plan [62]. As with most available services, initial indications confirm the popular acceptance of making legitimate online purchases. They estimate that the later receives up to 3 million requests for streamed music per day. With that level of

**Table 8 – Subscription Tiers**

Price tiers are as follows:
* <b>"Basic"</b> : offers 20 streams and 20 downloads for \$3.95 per month
* <b>"Standard"</b> : unlimited streaming and downloading for \$8.95 per month
* <b>"Premium"</b> : unlimited streaming and downloading and the ability to burn 10 songs to CD each month for \$17.95 per month.

Courtesy – Broadbandreports.com

potential, there should be no surprise why they have launched a new dedicated service. Not only have the large organizations entered into the digital age, there are also many smaller entities that are striving to enter this new world. [63]

Even artists, who were involved with bringing this issue to the forefront, are themselves beginning to take notice of this potential and getting into the game. Metallica recently began to provide samples of their works in progress via their official web site: <http://www.metallica.com>. Though these samples are low-quality copies of practice sessions and studio productions, they serve to give their audience a taste for the contents of their upcoming album. Though not a full-fledged adoption, it still shows that they are beginning to consider and have actually adapted, to some extent, an online existence. All these examples show that the music industry, right now, is in such a fluid state, they are beginning to move in an Internet enabled direction, in many cases with the utilization of DRM technologies. With new announcements being made every day and more and more options available for shopping online for digital music, it's very difficult for customers to keep abreast of all these changes.

Emerging web sites have begun to surface, such as one developed by the International Federation of the Phonographic Industry (IFPI). This site was designed to educate the public about what the music industry has been concerned with and what customers can do to help alleviate some of the problems. Their approach is to show the ill effects of illegal downloading of music, while at the same time striving to inform customers of the legal means of purchasing music online. A link is provided (<http://www.pro-music.org/musiconline.htm>) that takes customers to a page, which lists legitimate pay-for-music sites. This list can also be found in Appendix C. The gamut of industry news and new developments certainly show that the music industry is pushing forward with the idea of offering their content online. The Internet has provided the mechanism for music delivery, while the technologies of DRM will pave the way for the music industry to evolve in the direction of a full blown online existence.

## XII.C.

The music industry, in the last couple of years, has been abuzz with news and controversy. With all that is going on, it is difficult to ascertain what the industry may look like in the years to come. Some attempts have been made with regard to the future landscape of the music industry. The Gartner Group, in 2000, came up with a list of predictions based on market analysis. See **Table 9** below. To date, the predictions that have been made are holding true. As the list shows for the year 2003, it is clear that the music industry has begun to make available a number of production launches. Following these predictions, online hungry customers can rest assured that they will have full access to music content via the Internet in the very near future. The next few years will be very critical for determining how successful selling music through online means will be for the music industry. Industry adoption will be dependant on the successfulness of DRM and customer acceptance. Future success will be a culmination of many different factors, which will collectively contribute to the end result. [64]

**Table 9 – Media Industry Adoption of DRM**

Year: Stage of DRM Evolution	Characteristics of Stage
2000: Education	<ul style="list-style-type: none"><li>• DRM vendors earn little or no revenue, most survive on their venture capital</li><li>• Most vendor time and money spent on educating potential customers on the merits of DRM</li><li>• Music industry evaluates DRM technology but questions remain about consumer acceptance</li></ul>
2001 2002: Early Adoption	<ul style="list-style-type: none"><li>• Experimentation, pilot projects</li><li>• Cost models and issues need to be explored and stabilized</li><li>• Business-to-business (B2B) and business-to-consumer (B2C) applications are piloted</li><li>• User perceptions of ease of use must be addressed</li></ul>
2003: Production Launches	<ul style="list-style-type: none"><li>• Critical year for DRM adoption</li><li>• Success of early implementations should indicate the strength of DRM demand and point to leading vendors</li><li>• DRM vendors will partner with document</li></ul>



	management vendors to manage and control content across its life cycle
2004 - 2005: Growth and Maturity	<ul style="list-style-type: none"><li>• DRM vendor revenue models will stabilize</li><li>• Core functionality will stabilize and additional enhancements will differentiate solutions</li></ul>
2006: Market Consolidation	<ul style="list-style-type: none"><li>• Standardization of rights language commoditizes DRM, weak vendors are acquired or disappear</li><li>• Vendors seek differentiation through partnerships and/or vertical applications</li></ul>

Courtesy – Gartner Group's Timetable for DRM [adapted from: Weintraub, 2001]

## Conclusion:

### XIII.

Though the Internet has proven to be a place for copyright infringement and perhaps an area where the sale of digital music content would otherwise be undesirable, this has been rapidly changing. DRM and electronic commerce technologies are welcoming the free and protected distribution of copyrighted material and creating a launching pad for the music industry to securely market, sell and conduct a variety of online operations. Prior to becoming an acceptable alternative to the more traditional means of music distribution, though, several aspects of the industry itself will need to evolve in support of this new approach.

The scope of changes will come about through technology, legislation, and sound approaches to conducting online commerce. Standardization of the technologies used to digitally render and protect music will need to be ratified. This will lead to interoperability of consumer media players, an essential requirement for the consumer, allowing for music portability. Along with this notion will be the evolution of business practices tailored to the online community. These practices will need to consider the ramifications related to pricing and even redefine the music product itself. Customers have shown that there is no longer an interest in the prepackaged product and the single song is the newly desired commodity. This could work in the favor of the

music industry provided they adopt new business models that support what the customer desires. Moreover, saving will be incurred through elimination of production and distribution costs. Customers have become quite aware of this fact. The music industry should not overlook this revelation when considering a pricing structure for online sales of music. Bringing together reasonable prices, ease and flexibility, and new and creative business ideas, a business environment can be created which is capable of rivaling any other business format ever known by the music industry. Recent developments, such as that experience by Apple's Music Store, have certainly illustrated the potential of selling music online. This can be attributed to sound business design, to include reasonable pricing, flexible consumer usage privileges and a top rate customer interface. Further driving this movement will be the acceptance of those in the music industry itself. Full adoption will only come about through proven results. DRM will enable the secure distribution of the music product though an open environment such as the Internet.

Though technology has brought about a great deal of heartache and change for the music industry this does not have to be the accepted outcome. This paper has shown that technology can be used to turn the tides and allow for the legitimate distribution of music via the Internet. DRM will provide the tools and resources needed to bring the industry into the next phase of business. The music industry will be poised to cash in on this new revolution, while music enthusiast will gain what they demand. Yes, free is hard to beat-but by providing an alternative that is robust, fair and an attractive means of offering music over the Internet will, in the end, prove to be beneficial to all involved.

The bottom line is that the music industry has taken notice of what customers are asking for and have begun to make strides toward the online distribution of the music product. DRM has and will continue to empower the industry to take advantage of the benefits behind Internet based

marketing and distribution. This paper gave several examples of this as seen in offerings such as Apple's iTunes Music Store, Universal Music Group and Virgin RADIOFREEVIRGIN online business models. These solutions would not have been possible without the use of DRM technologies. Five to ten years from now the music industry will have gained both full adoption of these technologies and a level of assurance in the online approach. This will result in a greater depth and breathe of offerings. The future will be bright for both customers and the music industry alike; brought about by a DRM enabled Internet.

The remainder of the page intentionally left blank.

## Glossary:

- “The Big Five” – A common reference to the top five recording labels. These would include: Universal Music Group, EMI Group, Sony Music Entertainment, BMG Entertainment and Warner Brothers Music.
- 3DES – An encryption algorithm that builds upon its successor; DES. DES is a symmetric, or private, key solution that relies on a 56-bit length key that it uses to encrypt each block of 64 bit block of the document to be encrypted. 3DES takes this one step further by using up to three consecutive keys for a total key length of 168 bits.
- AAC – See Advanced Audio Codec
- Advanced Audio Codec – Apple’s digital audio encoding protocol.
- Advanced Encryption Standard – A symmetric, or private, key encryption algorithm designed to support key lengths of 128, 192 and 256 bits. Developed by the U.S. government with the intentions that this algorithm will last well within the first half of the 21<sup>st</sup> century.
- AES – See Advanced Encryption Standard
- America OnLine – Popular internet service provider.
- AOL – See America OnLine
- Apple – Consumable device developer/manufacture and information service provided.
- B2C – See Business-to-Customer
- Brick-and-mortar – A physical establishment representing a business as apposed to a business strictly conducted thorough online means.
- Burn-bin – A digital container that holds a customers music selection that will eventually be copied to CD-R.
- Business-to-Customer – Business transactions that take place between customers and an established business
- CA – See Certificate Authority
- Cable modem – A high bandwidth alternative to accessing the Internet. Usually provided though the local cable company.
- CD-R – See Compact Disk-Recordable -
- CD-R Drive – A compact disk drive with the added functionality of copying information to special CD-R compatible media.
- CD-R media – A special type of compact disk media that can be used to store data.
- Central Processor Unit – Main component of most computer devices. Provides centralized control over other components of the computer.
- Certificate Authority – A trusted entity that is responsible for issuing digital certificates, which are then utilized to establish identity and trust relationships.
- Choiceboard – Web site and business concept designed around giving customers a choice in their purchases.
- Clearinghouse – A third party contracted to supply the goods of manufacture.
- Compilation – A collection of songs
- Copyright – Stipulates ownership of intellectual property. Under the laws of the U.S. copyright owners have the absolute control over how their individual works are used. This would include whether or not the work can be printed, distributed or copied. Furthermore, others who wish to use someone else’s property must get approval by the owner.
- CPU – See Central Processor Unit
- Cyberspace – Common name used to refer to the environment “within” the space of the Internet.

Including email, web, newsgroup, etc.

Demographic profile – Customer profiles base on information specific to that group. Elements associated with a profile may be age, geographic distribution and gender to name a few.

Dial-up – Low bandwidth option to accessing the Internet.

Digital certificate – A digital container hold several pieces of identification information. Such a certificate would include ones name, serial number (or some other identifiable data), date of expiration and the public key of the digital certificates owner.

Digital Millennium Consumers Rights Act – A bill presented in 2003 to the U.S. Congress in an attempt to re-gain some of the consumer rights lost in the DMCA. An example of these rights would include some of the fair-use provisions that have been jeopardized with the ratification of the DMCA.

Digital Millennium Copyright Act – An act issued into law in 1998, which serves to address a variety of copyright issues as they apply to the digitally formatted intellectual property.

Digital Object Identifier – A piece of information that can be used to identify the device or individual within a networked environment. This can be a PSN, digital certificate or any other piece of information that is unique and traceable back to its original destination.

Digital signature – A unique identification mechanism that can be used to prove the source of the signature. Often used in the same manner as a hand written signature.

Digital Subscriber Line – A high bandwidth alternative to accessing the Internet. Usually provided though the local Telco lines.

Digital watermark – Additional information embedded into a digital file and which does not affect the quality of the original files. This information can be extracted and used to support a variety of business initiatives and to also control the content itself.

DMCA – See Digital Millennium Copyright Act

DMCRA – See Digital Millennium Consumers Rights Act

DOI – See Digital Object Identifier

DRM – See Digital Rights Management

DSL – See Digital Subscriber Line

Ebooks – The digital equivalent of a physical book.

Encryption – A term to describe the mathematical process of creating a version of an original document into a form that is unusable. Only those with the proper decryption keys and tools will be able to view and/or use the original document or information.

EPAC format – Lucent's Perpetual Audio Coder used in some digital music player solution.

Extensible Markup Language – A special document description language that can be used to send a variety of information about a particular document. This information can then be used to send handling and rendering instructions along with the original work.

File sharing – The act of transferring files to another party or central repository. This can be accomplished though standard means, such as FTP, or a host of other alternatives.

File Transport Protocol – An Internet protocol used to receive or send files across networks.

Fingerprinting – In the digital realm this is a process of taking a sample of an original piece of information and running it through an mathematical calculation to retrieve anther piece of information that can be used to identify the original.

FTP – See File Transport Protocol

Gnutella – Popular file sharing network.

Hash algorithm – A special algorithm used in the creation of digital signatures. The computational functions of the algorithm take a portion of the information being signed and

create a mathematically related representation of the original data otherwise known as a message digest.

IFPI – See International Federation of the Phonographic Industry

Intellectual Property – The act of ownership of information that has been created, assembled or rendered by a particular entity.

International Federation of the Phonographic Industry – An international group of music industry players.

Internet Radio – Synonymous to traditional radio but rather transmitted over the Internet.

Internet Relay Chat – An Internet protocol used to send instant messages between two parties.

iPod – Apple's portable music player.

IRC – See Internet Relay Chat

iTunes – Apple's solution to online music availability.

Kazza – Popular Internet file-sharing network based out of Australia.

Liquid Audio Player – Popular digital music player.

Message digest – The result for running a hash algorithm on any piece of data. This is a mathematical representation of the original data.

Metadata – Usage permissions and handling instruction information associated with a particular piece of content and has been incorporated with the content itself.

MP3 – Format for rendering music in a digital form. Based off of the MPEG Audio standard.

MP3.com – A legitimate source of digital music download.

Music Store – Apple's online music storefront.

Musicmatch – Desktop media player supporting DRM implementation. Also includes a variety of music access services.

MusicNet – Another source for accessing digital music.

Napster – Popular and now defunct Internet file sharing network.

OMA – See Open Mobile Alliance

Online piracy – The illegal copying and distribution of digital material over electronic means. Typically via the Internet.

Open Mobile Alliance – Consortium of mobile device developers aimed at developing interoperability and global adoption of mobile devices.

P2P – See Peer-to-Peer

PCM – See Pulse Code Modulation

Peer-to-Peer – Transactions that take place from one person to another. Usually implying that there is no intermediary involved.

Postprocessing – General term used to describe actions taken on digital content after certain conditions have been met. Usually used to disable access to the content in question.

Price discrimination – A process where prices are adjusted in a fashion that is disadvantageous to a particular demographic profile.

Private key – The key of a public key pair that is kept secret. The owner can then use this key to encrypt or digitally sign messages or documents.

Processor Serial Number – A unique number embedded within many contemporary processor chips. The presence of this number allows for some measure of identifiability.

PSN – See Processor Serial Number

Public key – The publicly available key of the encryption key pair.

Public Key Cryptography – Or asymmetric cryptography involves two types of encryption keys. This would include one that is publicly available, public key, and another that is kept secret,

private key. This type of crypto system allows for unassociated parties to securely communicate. By encrypting a message or document with someone's publicly available key will create a scenario where only the person or entity with the corresponding private key will then be able to decipher the original message or document.

Pulse Code Modulation – A process where an analog signal is transformed to a digital representation.

QuickTime 6 – Apple's desktop media player, which also supports DRM implementation.

RealPlayer – Another popular desktop media player also supporting DRM.

Record labels – Companies that traditionally produce, promote and distribute music.

Recording Industry Association of America – A consortium of music industry players who collaboratively combat a wide range of industry confronting issues for copyright infringement and piracy of music.

RIAA – See Recording Industry Association of America

SDMI – See Secure Digital Music Initiative

Secure Digital Music Initiative – A consortium of music industry players who seek to develop a secure means of digital music distribution.

Secure Sockets Layer/Transport Layer Security – Technology used to create a secure channel through which two parties can communicate. Can also be used to support the establishment of trust relationships.

Self-destruct – A process based on time sensitive DRM technologies that can be used to disable access to, or destroy associated content.

Spread spectrum – A process of spreading, or splitting an analogue signal across a wide range of frequencies for transmission. Once received at the destination the signal is reassembled back into its original form.

SSL/TLS – See Secure Sockets Layer/Transport Layer Security

Super-distribution – A distribution concept where content is openly shared and freely available.

Trust relationship – A relationship between two parties that has established trust

Try-before-you-buy – A situation where customers are given the opportunity to sample, or try, a product prior to purchase.

WinAmp – Nullsoft's solution to the digital music player. Compatible with a variety of operating systems.

Windows Media Audio – Microsoft's desktop media player. Current versions incorporate Digital Rights Management technologies.

Windows Media Audio – Microsoft's digital audio format solution.

Windows Media Player – Popular digital music player available through Microsoft.

WMA – See Windows Media Audio

XrML – See Extensible Markup Language

## **Resources:**

### **Music Industry Groups:**

#### **International Federation of the Phonographic Industry (IFPI) - <http://www.ifpi.org/>**

"IFPI is the organization representing the international recording industry. It comprises a membership of 1500 record producers and distributors in 76 countries. It also has national groups in 46 countries. IFPI's international Secretariat is based in London and is linked to regional offices in Brussels, Hong Kong, Miami and Moscow."

#### **World Intellectual Property Organization (WIPO) – <http://www.wipo.org/>**

"The World Intellectual Property Organization (WIPO) is an international organization dedicated to promoting the use and protection of works of the human spirit. These works – intellectual property – are expanding the bounds of science and technology and enriching the world of the arts. Through its work, WIPO plays an important role in enhancing the quality and enjoyment of life, as well as creating real wealth for nations."

#### **Secure Digital Music Initiative (SDMI) - <http://www.sdmi.org/>**

"The Secure Digital Music Initiative (SDMI) is a forum that has brought together more than 200 companies and organizations representing information technology, consumer electronics, security technology, the worldwide recording industry, and Internet service providers."

#### **Recording Industry Association of America (RIAA) – <http://www.riaa.org/index.cfm/>**

"The Recording Industry Association of America is the trade group that represents the U.S. recording industry. Its mission is to foster a business and legal climate that supports and promotes our members' creative and financial vitality. Its members are the record companies that comprise the most vibrant national music industry in the world. RIAA® members create, manufacture and/or distribute approximately 90% of all legitimate sound recordings produced and sold in the United States."

### **DRM Resources:**

#### **Digital Rights Management News Daily (DRMDaily.com) – <http://www.drmdaily.com/>**

One-stop-shop for timely news and information centered on the Digital Rights Management industry. Special interest is placed on the technologies that comprise DRM and how businesses are using these technologies tools as well as any other news concerning issues with DRM.

#### **Electronic Privacy Information Center (EPIC) – <http://www.epic.org/privacy/drm/>**

This organization takes an apposing view to the whole DRM movement. EPIC looks at the ill effects and possible adverse consequences of DRM. A very information rich site with many links to other sites

#### **Internet Digital Rights Management (IDRM) – <http://www.idrm.org/>**



“IDRM is an IRTF (Internet Research Task Force) Research Group formed to research issue and technologies relating to Digital Rights Management (DRM) on the Internet. The IRTF is a sister organization of the Internet Engineering Task Force (IETF).”

### **Other Resources:**

**Copyrightnews.com – <http://www.copyrightnews.com/>**

Copyrightnews.com provides a collection of current developments and news at it relates to copyright issues. Archives are available back to 2000.

**PRO-MUSIC – <http://www.pro-music.org/musiconline.htm>**

Developed by the International Federation of the Phonographic Industry (IFPI) in an effort to educating customers. Information contained on the site pertains to such issues as copyright laws, what it takes to make music and industry news. Also included are links and information about legal means of obtaining digital music online.

**Record labels on the web – <http://www.rlabels.com/>**

“Welcome music lovers and information junkies. Here you'll find 5000+ links to record label web pages with more being added continually (dead links are cleaned out biweekly). Some of the pages are maintained by the labels themselves while others are fan-created discographies. This list does not include distribution-only labels, online stores, or band sites.”

### **DRM Industry Developers:**

The following vendors provide digital music applications that can be used to play digital music on a variety of technology platforms. Also made available is a suite of utilities and services that content providers may utilize in their effort to sell their music goods.

**Microsoft Media Player – <http://www.microsoft.com/>**

“Enjoy fast and flexible music and video playback with Windows Media Player 9 Series. Over 120 new features including Fast Streaming for instant-on playback, and Mini-player mode make this the best player yet. The latest version for Windows 98SE, Me, 2000, and best experienced with Windows XP!”

**RealAudio – <http://www.real.com/>**

“**Presenting RealOne™.** One easy way to play every major media format in one amazing Player it's a player, jukebox, media browser, and now with RealOne RadioPass. **All you need is One. RealOne.**”

**Liquid Audio – <http://www.liquidaudio.com/>**

Liquid Audio provides a wide range of services for both the consumer and those who wish to sell music through the Internet. The Liquid Player is available for free download for listening to a variety of formats of digital music. Distributors of music content can use a variety of services such as Liquid Audio's “Digital Music Distribution” and “Subscription” technologies.

**Winamp - <http://www.winamp.com/>**

Winamp is another popular music player that is available. Much like other solution this application also supports playback of multiple digital formats of music. Also available is the ability for users to maintain a play list of their music selections while provided customers with the option to purchase and/or stream music.

**Technology Sources:**

**Organization for the Advancement of Structured Information Standards (OASIS) - <http://www.oasis-open.org/>**

“OASIS is a not-for-profit, global consortium that drives the development, convergence and adoption of e-business standards. Members themselves set the OASIS technical agenda, using a lightweight, open process expressly designed to promote industry consensus and unite disparate efforts. OASIS produces worldwide standards for security, Web services, XML conformance, business transactions, electronic publishing, topic maps and interoperability within and between marketplaces.”

**Motion Pictures Exchange Group (MPEG) – <http://www.mpeg.org>**

“MPEG (pronounced M-peg), which stands for Moving Picture Experts Group, is the name of family of standards used for coding audio-visual information (e.g., movies, video, music) in a digital compressed format.

The major advantage of MPEG compared to other video and audio coding formats is that MPEG files are much smaller for the same quality. This is because MPEG uses very sophisticated compression techniques.

MPEG.ORG is the most complete and comprehensive index of MPEG resources on the Internet. MPEG.ORG is mostly focusing on the MPEG-1 and MPEG-2 standards.”

**World Wide Web Consortium (W3C) – <http://www.w3c.org>**

“The World Wide Web Consortium (W3C) develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential. W3C is a forum for information, commerce, communication, and collective understanding.”

**Internet Rights Management Forum (IDRM) – <http://www.idrm.org>**

“IDRM is an IRTF (Internet Research Task Force) Research Group formed to research issue and technologies relating to Digital Rights Management (DRM) on the Internet. The IRTF is a sister organization of the Internet Engineering Task Force (IETF).”

## References:

- 1 MP3 Chambers, MP3 Defined, <<http://www.musiccavern.com/mp3chambers/mp3-12.htm>>.
- 2 Krytzer, C., Websence Press Release, Beyond the Music: Peer-to-Peer File-Sharing Web Sites Grow 300 Percent, Driven by Swapping Movies, Games and More, Reports Websence Inc., San Diego, Jan. 23, 2003, <<http://www.websence.com/company/news/pr/03/012303.cfm>>.
- 3 Yamada, Ken, Shop Talk: Wake up, music industry, Commentary: For big music companies, lawsuits against Napster and MP3.com are off-key., May 2, 2000, <<http://www.redherring.com/industries/2000/0502/ind-shoptalk0502>>.
- 4 Millar, Stuart, Music firms losing digital piracy fight: New internet services feed demand for free downloads, The Guardian, February 8, 2002, <<http://media.guardian.co.uk/newmedia/story/0,7496,646960,00.html>>.
- 5 Creative Commons, <<http://www.creativecommons.org>>.
- 6 CNN- Content, <<http://www.cnn.com/interactive/entertainment/0101/cd.price/content.html>>.
- 7 Carton, Kevin, That's (Digital) Entertainment, October 2003, <<http://pwc.com/extweb/newcolth.nsf/0/E19F0D7CCD938E9985256DAA005FCFC7F4?OpenDocument>>.
- 8 What is piracy? <[http://www.ifpi.org/site-content/antipiracy/what\\_is\\_piracy.html](http://www.ifpi.org/site-content/antipiracy/what_is_piracy.html)>.
- 9 International – Asian Businesses, Japan's Music Industry Is Losing Its Groove: Illegal CD copying and fan boredom clobber sales, June 10, 2002, <[http://www.businessweek.com/print/magazine/content/02\\_23/b37](http://www.businessweek.com/print/magazine/content/02_23/b37)>.
- 10 Menta, Richard, Ipsos-Reid: More Americans Taste Tunes on Net, MP3newswire.net, December 7, 2002, <<http://www.mp3newswire.net/stories/2002/tunetaste.html>>.
- 11 Berman, Jay, IFPI, Music Piracy Report 2002: Piracy – a blight on culture, a drain on economics, <<http://www.ifpi.org/site-content/antipiracy/piracy2002.html>>.
- 12 Ipsos-Reid: Downloading still popular in US, December 6, 2002, <[http://www.nua.ie/surveys/index.cgi?f=VS&art\\_id=905358641&re](http://www.nua.ie/surveys/index.cgi?f=VS&art_id=905358641&re)>.
- 13 Kushner, David, Digital Entertainment Post-Napster, E-Commerce Times, November 8, 2002, <<http://www.ecommercetimes.com/perl/story/19924.html>>.
- 14 Ewalt, David M., Executives outline ways for their businesses to profit in the wireless world, InformationWeek, March 10, 2003, <<http://www.informationweek.com/story/IWK20021017S0010>>.
- 15 The Digital millennium Copyright Act of 1998, U.S. Copyright Office Summary, December 1998, Pub.L. No. 105-304, 112Stat. 2860 (Oct. 28, 1998)
- 16 The Digital Millennium Copyright Act – Overview, The UCLA Online Institute for Cyberspace Law and Policy, February 8, 2001.
- 17 Unintended Consequences: Four Years under the DMCA, Electronic Frontier Foundation, <[http://www.eff.org/IP/DMCA/20030102\\_dmca\\_unintended\\_consequences.html](http://www.eff.org/IP/DMCA/20030102_dmca_unintended_consequences.html)>.
- 18 Grebb, Michael, Bill: Copyright Power to People, Wired News, October 4 2002, <<http://www.wired.com/news/politics/0,1283,55569,00.html>>.
- 19 McCullagh, Declan, Congress to take on spam, copyright, CNET News.com, January 8, 2003, <[http://news.com.com/2100-1023-979623.html?tag=fd\\_lede1\\_hed](http://news.com.com/2100-1023-979623.html?tag=fd_lede1_hed)>.

- 20 Schneier, Bruce, The Futility of Digital Copy Prevention, Counterpane Internet Security, Crypto-Gram Newsletter, May 15, 2001, <<http://www.counterpane.com/crypto-gram-0105.html#3>>.
- 21 Digital Rights Management – What is it and why is it needed? macrovision, 2002, <<http://www.macrovision.com>>.
- 22 Iannella, Renato, Digital Rights Management (DRM) Architectures, D-Lib Magazine, June 2001, Volume 7 Number 6, ISSN 1082-9873.
- 23 Kwok, Sai H., Digital Rights Management for the Online Music Business, ACM SIGecom Exchanges, Vol. 3, N0. 3, August 2002, Pages 17-24.
- 24 Ibid.
- 25 Stamp, Mark, Digital Rights Management: The Technology Behind the Hype, August 29, 2002.
- 26 Linnartz, Jean-Paul M.G., Electronic Watermarking, a Technical Mechanism for Content Protection, Phillips Research, January 17, 2002.
- 27 Cox, Ingemar, Miller, Matthew and Bloom, Jeffrey, Digital Watermarking, Morgan Kaufmann Publishing, 2002, Books24X7.com.
- 28 Koukopoulos, D. K., Stamatiou, Y. C., A Compressed-Domain Watermarking Algorithm for Mpeg Audio Layer 3, Computer Technology Institute (CTI) and Patras University, Riga Fereou 61, Patras, Greece, <<http://www.acm.org/sigs/sigmm/MM2001/ep/koukopoulos/>>.
- 29 Kirovski, Darko and Malvar, Henrique, Robust Covert Communications over a Public Audio Channel using Spread Spectrum, Microsoft Research, One Microsoft Way, Redmond, WA 99052.
- 30 Metois, Eric, Audio Watermarking and Applications, September 1999.
- 31 Martin, Richard, New Keys to Content: Rights Management Systems Foreshadow Metered Net, abcNEWS.com, December 17, 2000, <<http://abcnews.go.com/sections/tech/DailyNews/seibold3.990901.html>>.
- 32 Introduction to Public Key Infrastructure, Artisoft, [http://www.arctisoft.com/wp\\_pki\\_into.htm](http://www.arctisoft.com/wp_pki_into.htm).
- 33 Ibid.
- 34 Hartman, Darren, Network Security Analyst, ICSA Labs. Personal interview. 23, July 2003.
- 35 Coble, Howard, Digital Rights Management Solutions, Committee on the Judiciary, Subcommittee on Courts, Internet, and Intellectual Property, Association for Competitive Technology, June 4, 2002, <<http://ACTonline.org>>.
- 36 Rescorla, Eric, SSL and TLS: Designing and Building Secure Systems, Addison-Wesley, Boston, 2001, pp 58-59, 96-97.
- 37 Current Solutions for Securing Digital Media, ITG, IT GlobalSecure, Inc., <<http://www.itglobalsecure.com/en/home/Details/Challenge%20of%20Securing%20Digital%20Media%20-%20Solutions.htm>>.
- 38 Weinberg, Jonathan, Hardware-Based ID, Rights Management, and Trust Systems
- 39 Jones, Christopher, SDMI: Divide or Conquer? Wired News, November 18, 1999, <<http://www.wired.com/news/technology/0,1282,32513,00.html>>.
- 40 Amis, Dave, Digital Rights Management Revisited, internet freedom, April 8 2001, <<http://www.netfreedom.org/news.asp?item=152>>.

- 41 Clarke, Roger, DRM Will Beget DCRM, Xamax Consultancy Pty Ltd, 2001, version 2, January 2, 2001, <<http://www.anu.edu.au/people/Roger.Clarke/II/DCRM.html>>.
- 42 Digital Rights Management and Privacy. EPIC Digital Rights Management and Privacy Page, Electronic Privacy Information Center, <<http://www.epic.org/privacy/drm/>>.
- 43 Stefik, Mark, The Internet Edge: Social, Technical, and Legal Challenges for a Networked World, The MIT Press 1999, ISBN: 026219, Books24X7.com.
- 44 Opt.Cit. 34.
- 45 Boulton, Clint, All for One Unified DRM Solution Say "Aye", August 29, 2001
- 46 The Secure Digital music Initiative (SDMI), printed March 18, 2003, <<http://www.sdmi.org>>.
- 47 Fisher, William, Digital Music: Problems and Possibilities, October 10, 2000, <[http://www.law.harvard.edu/Academic\\_Affairs/coursepages/tfisher/Music.html](http://www.law.harvard.edu/Academic_Affairs/coursepages/tfisher/Music.html)>.
- 48 Technoloiges & Tools > Digital Rights Management > Benefits of DRM, Windows Media Rights Manager Benefits, Windows Media, printed November 7, 2002, <<http://www.microsoft.com/windows/windowsmedia/wm7/drm/benefits.asp>>.
- 49 Sculley, Alan, Too Many O.A.R.s in the Water?, CityBeat, Vol. 9, Issue 18, March 12, 2003, <<http://www.citibear.com/2003-03-12/music2.shtml>>.
- 50 Cresswell, Steve. Protecting Your Digital Content. The Gate House, v2.2, July 19, 2000, <[http://techlibrary.insurancetech.com/data/detail?id=990609052\\_534&type=RES&x=972753811](http://techlibrary.insurancetech.com/data/detail?id=990609052_534&type=RES&x=972753811)>.
- 51 Duhl, Joshua, Kevorkian, Susan. "Understanding DRM Systems". An IDC White Paper. IDC. 2001, <<http://www.intertrust.com/main/technology/whitepapers/IDCUnderstandingDRMSystems.pdf>>.
- 52 Densmore, Bill, Music-Online: Study documents vast changes expected in music industry; Role of "label" will be reduced; but artist power increasing, Newshare, July 22, 2002, <[http://olivetti.newshare.com/artman/publish/printer\\_110.shtml](http://olivetti.newshare.com/artman/publish/printer_110.shtml)>.
- 53 King, Brad, Fans: Music Should Rock, Not Lock, WiredNews, June 6, 2002, <<http://www.wired.com/news/mp3/0,1285,52895,00.html>>.
- 54 Zapf, Mariko, Downloads Did Not Cause The music Slump, But They Can Cure It, Reports Forrester Research: Digital Music Subscriptions And Downloads Will Exceed \$2 Billion By 2007, Forrester Research, August 13, 2002, <<http://www.forrester.com/ER/Press/Release/0,1769,741,00.html>>.
- 55 Zeidler, Sue, Universal Music Kicks Off Digital Download Plan, Reuters Internet Report, November 20, 2002.
- 56 EMI To Launch Biggest Online Programme In Europe; Track Can Be Downloaded, Burned, Copied To Portables, April 23, 2003, EMI Group, <<http://www.emigroup.com/news/pr192.html>>.
- 57 Radio Free Virgin. Advertisement. February 12, 2003 <<http://www.radiofreevirgin.com/>>.
- 58 Cohen, Peter, Apple music service forthcoming?, MacCentral, March 4, 2003, <<http://maccentral.macworld.com/news/2003/03/04/applemusic>>.
- 59 Coursey, David, How Apple got music download right, AnchorDesk, May 2, 2003, <<http://www.zdnet.com/ancordesk/stories/story/0,10738,2913553,00.html>>.
- 60 Let Someone Else Do It: Dig Tunes, Reuters, Wired News, May 26, 2003, <<http://www.wired.com/news/digiwood/0,1412,58998-2,00.html>>.
- 61 Napster set to return, Reuters, CNN.com, February 25, 2003,

- <http://us.cnn.com/2003/TECH/internet/02/25/music.napster.reut/>.
- 62 Bode, Karl, Napster Lives: On-line music slowly goes legit? BroadBand Reports.com, February 27, 2003.
- 63 Wells, Jane, AOL unveils MusicNet music service: Online service will reach broadest audience to date, MSNBC.com, February 26, 2003, <<http://stacks.msnbc.com/news/877605.asp>>.
- 64 Russ, Austin, Digital Rights Management Overview, SANS Institute, July 26, 2001, <<http://rr.sans.org/securitybasics/rights.php>>.

## Appendix A:

Domestic music piracy levels around the world in 2001 (units)				
	Over 50%	25-50%	10-25%	Less than 10%
NORTH AMERICA				Canada
				USA
EUROPE	Bulgaria	Cyprus	Croatia	Austria
	CIS-(other)	Czech-Republic	Finland	Belgium
	Estonia	Italy	Hungary	Denmark
	Greece	Poland	Netherlands	France
	Latvia	Slovakia	Slovenia	Germany
	Lithuania	Spain	Turkey	Iceland
	Romania			Ireland
	Russia			Norway
	Ukraine			Portugal
				Sweden
				Switzerland
				UK
ASIA	China	India	Hong-Kong	Japan
	Indonesia	Philippines	Singapore	
	Malaysia	Taiwan	South-Korea	
	Pakistan	Thailand		
LATIN AMERICA	Bolivia	Argentina		
	Brazil	Chile		
	Central-America	Uruguay		
	Colombia			
	Equador			
	Mexico			
	Paraguay			
	Peru			
	Venezuela			
AUSTRALASIA				Australia
				New Zealand
MIDDLE EAST	Egypt	Israel	Bahrain	UAE
		Kuwait	Oman	
		Lebanon	Qatar	
		Saudi Arabia		
AFRICA	Kenya		Ghana	
	Nigeria		South-Africa	
			Zimbabwe	






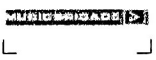





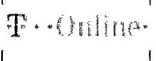











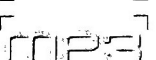








## Appendix B:

### DIGITAL MUSIC DOWNLOADS: RETAIL AFFILIATES

<a href="#"><u>AudioCandy</u></a>	<a href="#"><u>BestBuy</u></a>
<a href="#"><u>BET</u></a>	<a href="#"><u>Cats</u></a>
<a href="#"><u>Circuit City</u></a>	<a href="#"><u>Collegeconcerts.com</u></a>
<a href="#"><u>Compact Disc World</u></a>	<a href="#"><u>Corner CD</u></a>
<a href="#"><u>Dimples</u></a>	<a href="#"><u>DoTheHole.com</u></a>
<a href="#"><u>Earwax</u></a>	<a href="#"><u>Electric Fetus</u></a>
<a href="#"><u>Face the Music</u></a>	<a href="#"><u>Exitos Musical</u></a>
<a href="#"><u>FYE</u></a>	<a href="#"><u>Gallery of Sound</u></a>
<a href="#"><u>Independent Record</u></a>	<a href="#"><u>Latinoise.com</u></a>
<a href="#"><u>Mainstreet</u></a>	<a href="#"><u>Millennium Music</u></a>
<a href="#"><u>MIRA Coalition</u></a>	<a href="#"><u>MP3.com</u></a>
<a href="#"><u>Music Millennium</u></a>	<a href="#"><u>Music Rebellion</u></a>
<a href="#"><u>New World Record</u></a>	<a href="#"><u>Quonset Hut</u></a>
<a href="#"><u>Rasputin</u></a>	<a href="#"><u>Record &amp; Tape Trader</u></a>
<a href="#"><u>Rolling Stone</u></a>	<a href="#"><u>Top Hits Music</u></a>
<a href="#"><u>Tower</u></a>	<a href="#"><u>Windows Media</u></a>



## Appendix C:

DIGITAL MUSIC SERVICES <small>Some of the pioneers and subsequent ones</small>		DIGITAL MUSIC SERVICES <small>Some of the pioneers and subsequent ones</small>	
	<b>Classical</b> <a href="http://www.classical.com">www.classical.com</a>		<b>MSN</b> <a href="http://www.msn.co.uk">www.msn.co.uk</a>
	<b>Dot Music</b> <a href="http://www.dotmusic.com">www.dotmusic.com</a>		<b>MTV</b> <a href="http://www.mtv.com">www.mtv.com</a>
	<b>Dot Music On Demand</b> <a href="http://www.dotmusic.com/ondemand">www.dotmusic.com/ondemand</a>		<b>Music Brigade</b> <a href="http://www.musicbrigade.com">www.musicbrigade.com</a>
	<b>Ecompil</b> <a href="http://www.ecompil.fr">www.ecompil.fr</a>		<b>Pop File</b> <a href="http://www.popfile.de">www.popfile.de</a>
	<b>Fnac</b> <a href="http://www.fnac.com">www.fnac.com</a>		<b>Tiscali</b> <a href="http://www.tiscali.com">www.tiscali.com</a>
	<b>Freemove</b> <a href="http://www.freemove.com/musicclub">www.freemove.com/musicclub</a>		<b>T-Online</b> <a href="http://www.t-music.t-online.de">www.t-music.t-online.de</a>
	<b>HMV</b> <a href="http://www.hmv.co.uk">www.hmv.co.uk</a>		<b>Virgin Megastores</b> <a href="http://www.virginmega.fr">www.virginmega.fr</a>
	<b>M.Dir.bg</b> <a href="http://m.dir.bg">m.dir.bg</a>		<b>Vitaminic</b> <a href="http://www.vitaminic.com">www.vitaminic.com</a>
	<b>Ministry Of Sound</b> <a href="http://www.ministryofsound.com">www.ministryofsound.com</a>		<b>Wippit</b> <a href="http://www.wippit.com">www.wippit.com</a>
OTHER USEFUL MUSIC WEBSITES		OTHER USEFUL MUSIC WEBSITES	
	<b>Aki Musica</b> <a href="http://www.telefonica.es/index/akimusica.html">www.telefonica.es/index/akimusica.html</a>		<b>Emusic</b> <a href="http://www.emusic.com">www.emusic.com</a>
	<b>Alapage</b> <a href="http://www.alapage.fr">www.alapage.fr</a>		<b>Gracenote</b> <a href="http://www.gracenote.com">www.gracenote.com</a>
	<b>All Music Guide</b> <a href="http://www.allmusicguide.com">www.allmusicguide.com</a>		<b>MP3.com</b> <a href="http://www.mp3.com">www.mp3.com</a>
	<b>Amazon.com</b> <a href="http://www.amazon.com">www.amazon.com</a>		<b>On Demand Distribution</b> <a href="http://www.od2.com">www.od2.com</a>
	<b>Amuseic</b> <a href="http://www.amuseic.dk">www.amuseic.dk</a>		<b>Video TV</b> <a href="http://www.video.tv">www.video.tv</a>
	<b>Artist Direct</b> <a href="http://www.artistdirect.com">www.artistdirect.com</a>		<b>Virgin Megastores</b> <a href="http://www.virginmega.co.uk">www.virginmega.co.uk</a>
	<b>Blue Yonder</b> <a href="http://www.blueyonder.co.uk">www.blueyonder.co.uk</a>		<b>Wanadoo</b> <a href="http://www.wanadoo.fr">www.wanadoo.fr</a>