

December 2001

# Digital Rights Management for Music Filesharing Communities

Willms Buhse

*AIB TU Munich and Bertelsmann Digital World Services*

Follow this and additional works at: <http://aisel.aisnet.org/amcis2001>

---

## Recommended Citation

Buhse, Willms, "Digital Rights Management for Music Filesharing Communities" (2001). *AMCIS 2001 Proceedings*. 296.  
<http://aisel.aisnet.org/amcis2001/296>

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2001 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact [elibrary@aisnet.org](mailto:elibrary@aisnet.org).

# DIGITAL RIGHTS MANAGEMENT FOR MUSIC FILESHARING COMMUNITIES

**Willms Buhse**  
AIB TU Munich and  
Bertelsmann Digital World Services  
Willms.Buhse@dwsco.com

## Abstract

*File Sharing has become the most popular form of online community building in the music industry. Though, chat, instant messaging and other communication tools are offered for virtual communities like Napster, users spend by far more time browsing and sharing content. Nevertheless, this essential and widely adopted system has to be compliant with current copyright legislation. In 1999 and 2000, the concept of digital rights management was developed and implemented by major labels but so far lacked broad consumer acceptance.*

*This paper examines digital rights management technologies in the context of file sharing systems for music. Music labels protect their rights by using digital rights management technology that allows to control the access to music files using encryption or watermarking. In conjunction with peer-to-peer technology consumers also can use a mechanism called Super-Distribution with which they can share and recommend songs among end devices.*

*Looking at the possibilities for a successful implementation of digital rights management technology, a differentiation is made between the PC environment and other entertainment end devices. The paper concludes with a recommendation to music labels and related industries to participate in the effort of broad adoption of file sharing technology combined with digital rights management with a special focus on end devices.*

## Introduction

This paper will examine the possibilities, digital rights management technologies offer in the context of file sharing. Therefore, watermarking and Super-Distribution mechanisms are being looked at and evaluated according to their impact on potential business models for online music. In this article, online music is defined as commercially available digital music that is distributed over networks such as the Internet. Thereby music has become the ideal case study for information sharing in communities with its unique availability in digital form on billions of CDs. Additionally, the existence of compression technologies like MP3, combined with growing bandwidth, allows for mass market consumption of high-quality music. The music industry, though small in its market size, has become a prominent case study for new technology concepts introduced by companies like Napster for peer-to-peer file sharing, InterTrust for digital rights management and others.

Though much literature can be found prognosticating a significant change in the competitive environment of the music industry, little research exists on the combination of file sharing systems and digital rights management technologies in the field of online music.<sup>1</sup> Concluding remarks are made about possible solutions for the music industry and recommendations for related industries.

---

<sup>1</sup>Zerdick, A. et al. (1999) p. 53

## Content Communities and File Sharing

The music industry adopted digital media long before any other mass media industry with the development of the synthesizer in 1960. With the advent of the synthesizer and further development with the MIDI standard in 1982, the way music was composed, produced and performed was revolutionized.<sup>2</sup>

On the consumer side, the digital era began in 1970 with the invention of the Compact Disc (CD). It was first introduced by Sony and Philips in 1980 and soon became the most popular medium for storage and distribution of digital music.

With the introduction of the Internet, end consumers started to use networks for the exchange of music instead of physical media and to build virtual communities to share their interest. From the beginning online music became an underground phenomenon.<sup>3</sup> The catalyst for this phenomenon was technology that created and sustained new forms of communities by dramatically diminishing the importance of geographical proximity, while historically, storage media and broadcast was used in the music industry to traverse distances.

Network technologies are creating a new, transparent market space in which offer and demand can be matched fast and at minimal costs. In electronic markets, producers are able to cut overheads and eliminate traditional elements of the distribution chain, while consumers were to benefit from unlimited choice and decreasing costs. Regarding changes in the value chain, new functions arise, which is defined in current literature as intermediaries. Typical functions of an intermediary are providing information about offer and demand, facilitate aggregation and distribution, and establish a trusted relationship. Additionally, secondary functions include payment transaction processing, financing etc.<sup>4</sup>

New intermediaries in the value chain of the music industry are file-sharing systems. Apparently, these file-sharing systems have helped to overcome spatial distance to also achieve social cohesion. This is achieved with community-building functionalities of attractive content and further more mechanisms for interaction like buddy lists, instant messaging and genre-oriented chat rooms, and especially the possibility to browse music taste on other peers hard drives.

As a result, within less than two years, Napster became the largest music library ever with about 1b titles, without economic incentive, marketing activities, and even more important without involvement of the music industry.<sup>5</sup> At a very high level, file sharing systems or peer-to-peer-networks (P2P) aggregate and distribute information. With either central or de-central listings, files be can searched for, transferred and stored locally. The main challenge for content owners is its mass phenomena. Since its launch, Napster attracted over 60 Million users who knowingly violate copyright laws.

While Napster through its partnership with Bertelsmann respects copyrights, plans membership fees and the compensation of content owners, other open-source-file-sharing systems are developed without any commercial purpose. Their purpose is to freely distribute information beyond any control. Examples are Gnutella<sup>6</sup> developed by Gene Kan and Freenet<sup>7</sup> designed by Ian Clarke. Both are designed to run de-centralized, which makes it almost impossible to control or shut down their operations. As a result, besides music files, other illegal content like children pornography and terrorist instructions can be found.

The main challenge of these systems is that they only can scale with resources like content, bandwidth and storage from their users. As their content can be viewed as public goods, these systems attract free riders not willing to give any contribution in return. During a study of the Gnutella Network, it was found, that 70 percent of the users don't give any contribution to the system, and that half of the searches were answered by just one percent of the participants.<sup>8</sup> Apart from significant loss of system performance with longer search and download times, it adds vulnerability to the system as it might collapse with the shut down of few peers. On the other hand, there are concepts like seti@home with users voluntarily contributing resources in exchange for prestige and reputation.

---

<sup>2</sup>Evans, P.; Wurster, T. (1999), p. 242.

<sup>3</sup>Pettauer, Richard (2000).

<sup>4</sup>Picot, A.; Reichwald, R.; Wigand, R. (2000), p. 377.

<sup>5</sup>Becker, A.; Ziegler, M. (2000) p. 14.

<sup>6</sup>[www.gnutellawego.com](http://www.gnutellawego.com).

<sup>7</sup>[www.freenet.sourceforge.net](http://www.freenet.sourceforge.net).

<sup>8</sup>Adar, E.; Huberman, B. (2000).

As a result, the Internet seems to have a significant impact on the music industry's revenue model. Once physical distribution is removed from the per-unit costs, three challenges arise for today's business model: First, the amount of legal and illegal offers increase as investments in distribution infrastructure, compared to physical distribution, are significantly lower. Second, without per-unit production costs, pricing becomes difficult to argue. Using file sharing, even distribution costs are shared among consumers, which might make it difficult for companies to rationalize any price point.<sup>9</sup> Third, without production cost, natural limits for price competition disappear.

On the other hand, online marketing provides a number of new services including versioning and personalization. Compared to traditional revenue models, the online music industry has more flexibility and more alternatives including single transactions, memberships or advertising for their products and services.<sup>10</sup>

## Privatization of Digital Goods using Digital Rights Management

The theory of public goods holds that goods have different characteristics whether or not there is rivalry or non-rivalry in using them. Public goods are non-excludable and non-rivalrous in consumption while private goods are sold to those who can afford to pay the market price.

In the music market, broadcasting as a public good is used to promote songs while CDs function as a container for music sold as private goods.<sup>11</sup> Copyrights are a means of establishing the boundaries between who is allowed to use a particular good and under which conditions, and who is not allowed to use it. Copyrights on information goods exchanged on the Internet exclude potential consumers from getting unconditional access to a product. Developments in technology seem to take away the grounds for these boundaries. Burke has shown how technological developments in the past gave rise to changes in copyright.<sup>12</sup> At the same time, piracy has always had a significant share in the music market. In 1999, according to IFPI about 1.9b units of illegal copies were found with a value of \$4,1b leading to a market share of 36%.<sup>13</sup> On the internet, piracy has become an even larger mass phenomenon due to the availability of perfect digital copies.

With non-excludable online-music, end consumers become free riders, which are not willing to pay the market price for music as long as others might be accessing the music for free.<sup>14</sup>

Protection technologies play an important role in determining whether a media product is a public or a private good.<sup>15</sup> To securely protect online music, all major labels have incorporated digital rights management technologies in 2000. These technologies basically fall into four categories: first the access is controlled at the users right of entry with passwords, encryption and/or authentication. Second, the usage is controlled according to rules that are set by the distributor of the music. This determines how the user can interface with the information, e.g., listen-only rights, where the user is unable to save or distribute the music. Third a tracking mechanism allows the information provider to track subsequent use with watermarking and digital footprints. Fourth and last, payment systems enable the information provider to generate revenue for the rights granted to the user. As a result of inefficient micro payment systems, subscription models are viewed as a method to overcome high transaction costs.<sup>16</sup>

In the following, two examples of implementations for digital rights management are given – a subscription model and a per-use or pay-per-item model, described as Super-Distribution.

---

<sup>9</sup>Albers, S.; Clement, M.;Skiera, B (1999), p. 82.

<sup>10</sup>Zerdick, A. et al.(1999), p. 23 .

<sup>11</sup>Tschmuck, P. (2000).

<sup>12</sup>Burke, A.E. (1996) p. 51.

<sup>13</sup>IFPI (2000) p.2 .

<sup>14</sup>Heinrich, J. (1994), p. 26.

<sup>15</sup>According to Forrester Research, 90 percent of the music companies are working with DRM-providern, 60 percent in publishing and 50 percent in the film industry. Schreier, E. (2000), p. 4.

<sup>16</sup>Picot, A.; Reichwald, R.; Wigand, R. (2000) p. 37.

## Subscription Models

For subscription models watermarking and other identification technologies<sup>17</sup> can provide important contributions to the field of intellectual property protection within a more extensive security framework for identification and proof of ownership, which is comparable to IRSC-Codes used by the GEMA for recognition of CD-Audios.<sup>18</sup> By embedding a watermark into the compressed audio signal during delivery, the customers are aware that a watermark may identify them.<sup>19</sup> Hence, they can be made responsible if the signal is found outside the legal domain by a trigger technology, even in a decompressed and analog representation.<sup>20</sup> In contrast to encryption technologies, watermarks could be used with today's infrastructure for CD-Audio as well as MP3-devices. Subscriptions bundle a large number of information goods for a fixed price. In a variety of circumstances, a multiproduct monopolist can extract substantially higher profits by offering one or more bundles of information goods than by offering the same goods separately.<sup>21</sup> At the same time, bundling can be used to introduce new artists and titles as a strategy to overcome the information paradox, which states that the value of an information can't be determined a priori of consumption.<sup>22</sup>

In this case, for the first time in their history, music labels have the opportunity to create a continuous relationship with the end consumer. This relationship offers a foundation on which music labels can generate revenues. The subscription model may represent a mix between indirect and direct revenues with the option of consumption combined with transparent pricing.<sup>23</sup> A premium membership might offer a flatrate, eventually combined with services from the second scenario, while a free membership might limit access in quantity, time or actuality combined with indirect revenues from promotion and advertising.

## Super-Distribution

In 1990, the Japanese Ryoichi Mori, who coined the term Super-Distribution for a new concept of licensing information, developed a visionary architecture for the distribution of digital goods.<sup>24</sup> The fundamental idea is to allow free distribution and copy of information, while controlling access to changes and usage with the owner defining the terms. According to his prototype, called Software Service System (SSS), which was implemented as a peer-to-peer-architecture, the following components must be available:<sup>25</sup>

- a persistent cryptographic wrapper must stay in place when the digital property is used, copied, redistributed, etc.
- a digital rights management system with a trusted tool that tracks the deals and the usage associated with the access to the digital property
- the payment information have to be exchanges securely among the parties

After securely encrypting the music with a key, the package can be digitally delivered to the consumers end device.<sup>26</sup> There, the locally installed trusted tool gains access to the digital content with an unlock key which leaves the file locally encrypted and streams the digital content into the memory for "on the fly" decryption. The user who has agreed to the terms and conditions of use, now has the license to access the content. His usage is recorded and the transaction is reported to a clearinghouse to initiate payments and backup system information. Using the Super-Distribution concept, consumers can recommend and share files among each other via email, FTP, physical media using file-sharing networks. Still the copyright is being protected and the content owner maintains control and determines payment collection.

For subscriptions, bundling was mentioned as being attractive for content companies to extract higher profits. In the music industry, this has always been the case with album sales, where only one or two hits from an entire album initiate the purchase.

---

<sup>17</sup> Among them are digital fingerprints and hash-function-based frequency analysis.

<sup>18</sup> Goldhammer, K.; Zerdick, A. (1999), p. 96.

<sup>19</sup> Tang, Puay (1998) p. 24.

<sup>20</sup> Specifications for such an infrastructure is currently designed by the Secure Digital Music Initiative. [www.sdmi.org](http://www.sdmi.org) SDMI, Document Nr. pdwg99070802, „SDMI Portable Device Specification Part 1, Version 1.0“, p. 21.

<sup>21</sup> Bakos, Brynjolffson (1999), p. 2f.

<sup>22</sup> Picot, A.; Reichwald, R.; Wigand, R. (2000) p. 372.

<sup>23</sup> Zerdick, A. et al. (1999), p. 26; Sinnreich, A. (2000), p. 12.

<sup>24</sup> Ryoichi Mori (1990); Cox, Brad (1996); Morin, Jean-Henry (1999) p. 22. It seems as if in parallel Brad Cox has developed a similar system, that is documented in 1994 with his system, CopyFree Software.

<sup>25</sup> Morin, Jean-Henry (1999) p. 21.

<sup>26</sup> Tang, Puay (1998) p. 23.

Digital products possess optimal de-bundling capability, which in return can be re-bundled again for custom-mixes.<sup>27</sup> With digital downloads and Super-Distribution, consumers might start “cherry picking” their hits and thereby endanger the traditional revenue model of album sales.

At the same time, Super-Distribution can be used to market content and benefit from the lead-time-advantage where information has higher value with minimal time lag.<sup>28</sup> The value of online music, might be highest close to the release date, where according to the windowing concept, highest profits can be made.<sup>29</sup>

In this case, using digital rights management and Super-Distribution, major labels maintain control over the distribution of music and might even be able to enforce their copyrights more than in the traditional world.

## **The Impact of End Devices on File Sharing**

File sharing systems are ment to stay and influence the digital distribution of music. Nevertheless, the music experience by using consumer end devices is different from the PC environment. In the PC environment, law suits from the RIAA against MP3.com, Scour and Napster and others in the U.S. demonstrate the music industry’s efforts to minimize copyright infringement. Though the industry might reach successes in certain countries, since global legislation will not be inacted any time soon concepts like “Offshore-Web-Hosting” from companies like HavenCo.Com or Offshore.com.ai and decentral file sharing systems like Gnutella and FreeNet might well continue to operate despite law suits and even drive consumers to “underground” systems.<sup>30</sup> Additionally, on the internet only a single copy made available (even by re-digitizing from analog versions) is sufficient to be globally distributed in a short period of time leading to a total loss of control by the owner. In the literature, many doubt that the music industry can successfully introduce security mechanisms that are either unbreakable or at least can raise the barrier for piracy without creating unproportional high costs.<sup>31</sup> Many examples in other media industries like currently the DVD-protection scheme have shown failures of secure protection mechanisms especially in the PC environment.

But it is quite possible that the biggest challenge the music industry is facing is not hackers but instead infrastructure. Today’s infrastructure with 200m multimedia PCs, 1b CD- audio-devices and 17b unprotected audio CDs with 150.000 different titles will be very difficult to replace.<sup>32</sup>

Regarding online music, portability, ubiquity and especially compatibility with end devices are not achieved yet. The traditional practices of collecting and gift giving music are not solved with digital goods and might result in long-term existence of traditional hardcopy media products. Nevertheless, substitution of traditional media like CDs and DVD-Audio might increase as soon as a comparable infrastructure for online music exists. Physical goods have always served as “containers” for services. For example, a CD has no intrinsic value, only the value of delivering music to your ears. In the age of downloadable music, though, the CD loses its value as a container for music.<sup>33</sup>

On the other hand, besides consumer’s resistance of paying for digital goods in the PC environment, the television and video games market have shown that consumers are willing to invest in entertainment and its related software products.

Therefore the next suggested step is the widespread implementation of file sharing and community based systems into end devices like DVD-players, gaming devices, cell phones and PDAs. Combined with services based on digital rights management including personalization, convenience, reliability and fast access to music almost anywhere and at anytime - referred to as the celestial jukebox.<sup>34</sup> It might be easy to maintain a piracy site with some illegal copies, but to provide access, payment mechanisms and

---

<sup>27</sup> Albers/Clement/Peters (1998) p. 275; Kulle, Jürgen (1998) p. 80.

<sup>28</sup> The classic example are stock quotes.

<sup>29</sup> Thurow, p.82; Zerdick, A. et al. (1999) p. 58f.

<sup>30</sup> Schreier, E. (2000), p. 9.

<sup>31</sup> Albers, S.; Clement, M.;Skiera, B. (1999), p. 83.

<sup>32</sup> Gurley, W. (2000), p. 268f.

<sup>33</sup> Rifkin, J (2000).

<sup>34</sup> Committee on Intellectual Property Rights and the Emerging Information Infrastructure (2000), p. 80f.

customer service to many thousand people simultaneously is a more complex task.<sup>35</sup> Here, the value for the consumer is perceived primarily in the functionality and services, rather than in the content itself.<sup>36</sup>

In this case, communities play a crucial role in attracting consumers and providing lock-in. Traditionally, radio stations and music label could only satisfy a broad audience, while the internet allows a segment between mass media and individual communication between 5000 to 10000 listeners.<sup>37</sup> In the networked economy, these versions and even individual products and services are achievable due to smaller transaction and production/service costs.<sup>38</sup> Using a feedback loop mechanism for online-music, personal playlists can be generated, recommended, updated and shared among other users. Online music, with about three minutes title length can generate comprehensive sets of data over time, provided 4 hours of daily music consumption, 80 songs might be rated on a daily basis almost automatically. Large description databases like Moodlogic or Gigabeat can analyze relationships among titles and artists according to rhythm, instruments, contextual information and even mood.

## Conclusion

After the debut of digital rights management technologies in 1999 and 2000, none of the implemented technologies could benefit from net effects like file-sharing systems did during the same time. Increasing concerns regarding piracy and the popularity of file sharing communities are leading to a revival of concepts like watermarking and encrypted Super-Distribution for music.

In this paper the importance of the end devices for the delivery of future media products can't be emphasized enough. Besides different spending behavior that might generate revenues for many online entertainment companies, the seamless management of rights and its billing processes seems to improve today's entertainment experience in the PC environment using first generation digital right management technology.

Therefore, the author recommends to music labels and related industries to participate in the effort of a broad adoption of file sharing technology combined with digital rights management with a special focus on end devices.

I would like to conclude with Shapiro & Varian that content owners should maximize the value of their digital goods and should not secure them for the sake of protection.<sup>39</sup> Therefore, the optimal strategy is not only to reduce the motives for copyright infringement, but at the same time to increase the accessibility for consumers to digital products and services.

## References

- Adar E., Huberman B. (2000) Free Riding on Gnutella, [http://www.firstmonday.org/issues/issue5\\_10/adar/index.html](http://www.firstmonday.org/issues/issue5_10/adar/index.html), viewed at December 10<sup>th</sup>, 2000
- Albers S., Clement M., Peters K. (1998) Marketing mit Interaktiven Medien. Strategien zum Markterfolg, Frankfurt am Main
- Albers S., Clement M., Skiera B. (1999) Wie sollen die Produkte vertrieben werden? – Distributionspolitik. In: Albers S., Clement M. et al E-Commerce – Einstieg, Strategie und Umsetzung im Unternehmen. Frankfurt am Main, pp 79-94
- Bakos Y., Brynjolfsson E. (1999) Bundling information Goods: Pricing, profits and Efficiency, Working Paper
- Becker, A.; Ziegler, M. (2000) Wanted: A survival plan for the music industry – Napster and the consequences, Diebold Study
- Burke, A.E (1996) How Effective Are International Copyright Conventions in the Music Industry? Journal of Cultural Economics, volume 20, number 1, pp. 51-66.
- Cox, Brad (1996) Superdistribution: Objects as Property on the Electronic Frontier.. Addison-Wiley,
- Deutsch Bank UK (2000) New Media Mechanics - Value of Content Online, London
- Evans, P.; Wurster T. (1999) Blown to Bits - How the new economics of information transforms strategy. Harvard Business School Press, Boston, Massachusetts
- Goldhammer, K.; Zerdick, A. (1999) Rundfunk Online – Entwicklung und Perspektiven des Internets für Hörfunk- und Fernsehanbieter, Berlin
- Gurley, W. (2000) Digital music: The real law is Moore's law, Fortune; New York; Oct 2, 2000;; Vol. 142, Issue: 7 pp 268f.

---

<sup>35</sup>Committee on Intellectual Property Rights and the Emerging Information Infrastructure (2000), p. 81.

<sup>36</sup>Deutsche Bank (2000) p. 14.

<sup>37</sup>Goldhammer, K.; Zerdick, A. (1999), p. 275 f.

<sup>38</sup>Piller, F. (1998) p. 16.

<sup>39</sup>Shapiro, C.; Varian, H.R. (1998) p. 97.

- Heinrich, J. (1994) *Medienökonomie.*, Vol. 1; Opladen Westdt. Verlag, 1994
- IFPI (2000) *Piracy Report 2000*, June 2000
- Kulle, Jürgen (1998) *Ökonomie der Musikindustrie: Eine Analyse der körperlichen und unkörperlichen Verwertung von Musik mit Hilfe von Tonträgern und Netzen*, Frankfurt a.M.
- Morin, Jean-Henry (1999) *Commercial Electronic Publishing over Open Networks: A Global Approach Based on Mobile objects (Agents)*. Dissertation University Genf
- Mori, R. (1990) *Superdistribution: The Concept and the Architecture*. The Transactions of the IEICE E73, No 7.
- NRC (2000) National Research Council, Committee on Intellectual Property Rights and the Emerging Information Infrastructure: *The Digital Dilemma – Intellectual Property in the Information Age*. National Academy Press, Washington, D.C.
- Picot, A.; Reichwald, R.; Wigand, R. (2001) *Die grenzenlose Unternehmung*, 4. Ed., Wiesbaden
- Piller, F. T. (1998) *Kundenindividuelle Massenproduktion. Die Wettbewerbsstrategie der Zukunft*, München.
- Rifkin, J (2000) *The Future of Digital Music: Is There an Upside to Downloading?* Hearing Statements U.S. Senate Committee on the Judiciary viewed at [http://www.senate.gov/~judiciary/7112000\\_jg.htm](http://www.senate.gov/~judiciary/7112000_jg.htm)
- Schreier, E. (2000) *Content out of Control*, The Forrester Report, Cambridge, MA, September 2000
- SDMI (2000) Document Nr. pdwg99070802, SDMI Portable Device Specification Part 1, Version 1.0
- Shapiro, C.; Varian, H.R. (1998): *Information Rules. A Strategic Guide to the Network Economy*, Boston
- Sinnreich, A (2000) *Digital Music Subscriptions: Post-Napster Product Formats*, Jupiter Study
- Tang, Puay (1998) *How Electronic Publishers are Protecting against Privacy: Doubts about Technical Systems of Protection* The Information Society v. 14, n. 1 (Jan-Mar 1998). pp 19-31
- Thurrow, N. (1994) *Die digitale Verwertung von Musik aus der Sicht von Schallplattenproduzenten und ausübenden Künstlern*, in: Becker, Jürgen / Dreier, Thomas, *Urheberrecht und digitale Technologien*, Vortragsammlung der Sitzung des Instituts für Urheber- und Medienrecht, UFITA-Schriftenreihe, Baden-Baden, pp 77
- Tschmuck, P. (2000) *Internetökonomie und Musikwirtschaft*. During: MICAFOCUS 1: REALES MUSIKSCHAFEN FÜR EINEN VIRTUELLEN MARKT March 18<sup>th</sup>, 2000, [http://www.mica.at/mf\\_tschmuck\\_p.html](http://www.mica.at/mf_tschmuck_p.html), viewed at 10.10.2000
- Zerdick, A. et al. (1999) *Die Internet-Ökonomie – Strategien für die digitale Wirtschaft*. Springer, Berlin, Heidelberg (u.a.)