

Piracy and Content Protection in the Broadband Age

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Abstract—The illegal distribution of copyrighted material has been blamed for vast losses incurred by publishing companies, especially in the entertainment industry. To this effect, Digital Rights Management (DRM) has been actively promoted as the solution to this problem. Critics of DRM however claim that DRM infringes on basic rights afforded by copyright law and is thus bad for consumers. Adding support for their claims is the incorrect and, in our opinion, illegal implementation of these systems. This paper introduces and debates these issues also discusses results of a survey we conducted over the Internet on the public's response to copyrighted works, DRM and piracy. Our findings conclude that while DRM is still necessary, piracy is neither a clear cut reason for a loss of sales nor a phenomenon easily explainable.

I. INTRODUCTION

Broadband Internet access is seen as a crucial component for economic growth for South Africa, and the South African government has placed a high emphasis on promoting wider, faster and more economical access to the Internet. The higher bandwidth offered by broadband Internet connections implies that multimedia rich offerings like streaming video and large data files are easily accessible at affordable rates.

Faster and more economical access to the Internet has also meant that transferring perfect copies of any digital data is also easier and more economical than ever before. This, and the growth of digital media offerings has meant that the Internet has become a very easy medium for the illegal reproduction and distribution of copyrighted works. This fact has been cited by many copyright holders, usually music record companies, as the primary reason for a drop in music CD sales.

However, combating piracy through the courts is often too expensive and not easily achieved thanks to the wide reach of the Internet and its relative anonymity offered by efficient peer-to-peer (p2p) networks. Preventing distribution of data is impractical, and thus record companies have in some instances opted to use *digital rights management* (DRM) technologies to prevent users from reproducing usable digital copies.

The availability of broadband in mobile devices through UMTS networks, and the popularity and market penetration of mobile devices has meant a wider accessibility of the Internet and data. There is also a greater interest from *content providers* in providing legal content to mobile devices as long as the content itself can be protected from misuse and illegal distribution.

Implementation of DRM has also brought with it a consequence that many legal actions that users could perform with ease are usually no longer possible, or if possible very limited [18]. Most of these actions fall under the “*fair dealing*” clause in the South African Copyright Act [1] (known as “*fair use*” and “*copyright exceptions*” in the USA and Europe respectively [8])¹, which are very difficult, if not impossible, to implement automatically in computer systems [15]. Furthermore, DRM systems usually provide rights holders the ability to assert more control on how a user uses a work, than they are legally entitled to in copyright law [9], [11], [21]. DRM systems have also raised the potential for rights holders to actively monitor usage of their works raising a number of privacy concerns in both public forums [4], [5] and academia [11], [14], [15], [18].

We believe that it is of paramount importance to examine the reasons behind piracy, and in this paper we discuss a selection of the results of an Internet survey we conducted in this regard. We also examine two DRM systems and why these systems are not, in general, accepted whole heartedly by the public, and in our opinion not legally compliant.

II. SURVEY METHODOLOGY

We conducted an online survey running over two weeks (end of May, beginning of June 2005). The survey consisted of 98 questions divided into three major sections:

- 1) **Physical media usage:** Since copyright law is almost entirely based on physical media, it is important to understand how well respondents understand copyright law.
- 2) **Digital piracy habits and the respondents' attitude to piracy:** This section intended to explore the respondents piracy habits, their attitude to piracy, their attitudes towards non-DRM enabled works and whether non-DRM enabled media would succeed in the marketplace.
- 3) **The respondents' attitude to DRM:** This section intended to explore the respondent's experience and attitude towards current DRM enabled media.

There was also a minor section on personal information such as age group, geographical location, income group etc. The responses from each section were stored separately allowing for

¹Fair use is a more well known term, and we have used this term in the paper.

the collection of incomplete responses. Most of the questions asked the responders to ignore open source and other works available freely in the public domain.

Because the targeted audience were Internet users, the survey was advertised mainly through online forums of high activity, catering for users of different age groups and from various parts of the world. In at least two of the forums, one of the authors has been an active participant for some time. Forums included music discussion forums, sport discussion forums, open source forums, a support forum for an online music store and an anime download forum². The aim was to attract a wide variety of regular Internet users, and forums provided an ideal mechanism for this purpose.

The survey was also advertised on a university IRC network and some email lists in the university. Due to the nature of the questions asked, the survey was completely anonymous and respondents were not tracked. Respondents were given a mechanism to contact the authors (through the use of an online form) if they so wished at the end of the survey.

There were 292 complete responses, although over 400 persons started the survey. We believe that the attrition is due to the length of the survey which was ambitious but required to obtain comprehensive result. We have only included complete responses in our analysis. However, we have discovered that there does not seem to be a significant change in our results if we include incomplete responses. Respondents from the survey were mainly male between the ages 18 – 35, and a large proportion of respondents were from South Africa and the United States of America. However, we had respondents from over 15 countries across 6 continents. Due to the wide variety and the relative low number of responses, comparing responses with respect to nationality is not feasible. Most of the questions asked in the survey utilised a rating scheme. However, instead of using numbers to denote the scale, we qualified the scale with a description.

III. GENERAL PATTERNS WITH REGARDS TO USAGE OF COPYRIGHTED WORKS

To understand how the public uses and expects to use digital copyrighted works, there is a need to understand how they use (or used to use) physical media.

A. Physical Media

An overwhelming majority of the respondents (95%) have lent physical works³ they have acquired to friends and family. A large percentage of the respondents (35%) have also resold their original acquisitions, when they were no longer desired or required. Backing up and format shifting often depends on the media, but music and videos had a very high percentage of activity in this regard (80% and 60% respectively), while

²Of current pirated media, “fansubbed” anime probably occupy an unique position. Many major anime series are “subbed” (subtitled in languages other than the native Japanese) and available for download. Anime production companies are well aware of the sites but do not usually interfere unless the anime is already available legally in the subbed language.

³By physical media, we include all media that come in some form of physical medium, including compact disks, books, records etc.

books, magazines etc. were not usually considered. All these activities are usually considered legal as fair use in copyright law.

However, not all activities by respondents were legal, but remained popular. For example, an overwhelming majority of the respondents (83%) have made copies of copyrighted materials for friends and family. (10%) of the respondents have even sold the copies that they have made. Most of these respondents have also distributed pirated digital media.

The majority of respondents (over 70%) preferred purchasing their media, and continue to use media as long as they are usable, some of which are over 20 years old. Although, on average, respondents do make more frequent usage of newer media than older media. This usage pattern is consistent for all media types (although at different usage levels) except for newspapers and magazines.

B. Acquisition of Pirated Materials

Only 5% of the respondents claimed to have “never acquired pirated material”. Thus 95% of the respondents have acquired pirated materials, and most (75%) have used p2p networks for this purpose. However, p2p networks are not only source of digital downloads, and 69% of the respondents have acquired pirated materials from sources other than p2p networks. In fact, while the Internet was the primary source of most of the respondents, 40% of the respondents who acquired pirated materials did not cite the Internet as the direct source of the pirated works. Instead friends and family (25%) and school or work networks (15%) were cited as their primary source of pirated material.

68% of the respondents have redistributed pirated materials they have acquired to friends and family while 40% of the respondents have made pirated materials available for download to large groups of people, usually anonymous. This implies that the “pirate network” extends far beyond the direct download from the Internet.

The results of the responses to piracy habits are very similar to a survey conducted in Europe by the INDICARE group in 2004 [12] confirming our approach and results.

C. Piracy and Morality

In most countries, most laws are enacted to define an existing natural position (e.g. right to life), a moral position or to protect the general public (e.g. consumption of alcohol and driving). However, copyright laws can be considered to be artificial as there is no natural protection for an idea (other than to keep the idea secret).

Thus it is not surprising that a majority of the respondents (57%) do not consider piracy to be wrong or immoral. In fact, 65% of the respondents that do consider piracy to be wrong, engage in the acquisition and distribution of pirated materials. Furthermore, many of the respondents (47%) regard sharing copyrighted materials *they own* as fair use.

In general, sharing of data on the Internet, whether legal or not, is largely altruistic in nature. Sharers often spend their own money for bandwidth, and there are instances where interested

parties will pay the host money to keep the servers online and available, even to non contributors. In some cases, the hosts do not accept donations after a certain pre-determined limit has been reached.

D. Motivation for Piracy

In the music industry, piracy has been blamed as the major reason behind the drop in sales of CD singles and other music records [6]. However, comments in public forums and others have commented that piracy need not be the only reason for the drop in sales [4], with reasons including the introduction of new formats, greater variety of entertainment media and the poor quality of new offerings. With legally downloaded music singles outselling traditional music CDs, this claim has been strengthened further [24].

The relative low price of pirated materials has been promoted as the main reason for piracy. However, in our survey, only a third of the respondents cited the cost as their primary motivation. Instead, they cited inconvenience of acquiring legal versions (34%), the unavailability of the material locally (16%) and the unavailability of material considered “out of date” by publishers and rights holders (11%) as their primary motivation for piracy.

Furthermore, just over a third of the respondents (34%) claimed to primarily download popular material intended for long term usage. A large proportion of the respondents downloaded material for short term usage (27%) or downloaded obscure, “unpopular” material not easily available legally (27%).

From these statistics, it is clear that only about a third of all downloads have an impact on potential sales. Even then, of the third, the impact on sales is even lower, as there will still be a proportion of respondents who do not possess the economic means to purchase all the material legally. The fact that there is such a huge demand for material considered old, obscure or for short term usage implies that current business models are not addressing the needs of the majority of the public. Thus, the claimed correlation between the loss of sales and piracy is much lower than claimed.

IV. DIGITAL RIGHTS MANAGEMENT

In our opinion, the loss in potential sales of physical media should not be used as the primary motivation for utilising DRM systems. Instead, the attitude towards the piracy of non protected, legal downloads holds the key.

A. Habits and attitudes towards non protected legal downloads

Only 24% of the respondents had made use of non DRM enabled media services like Magnatunes. In general, the financial success of such services are dwarfed by other legal download services such as iTunes. There was a 50-50 split between the respondents on whether they would acquire a pirated version (at the same quality) to a non-DRM enabled version for a *fair*

*price*⁴. This implies, that even with the availability of media at a price that the respondents considered affordable, piracy would continue.

Furthermore, 26% of the respondents would share legal, non DRM protected works on the Internet. A larger proportion of the respondents would share their acquisitions with their friends and family (78%), an unsurprising result considering their practices with physical media. Furthermore, half the respondents “would not mind” if their friends and family shared the acquisitions they purchased over the Internet.

From these numbers, it is clear that relying on the respect of copyright law will not prevent the distribution of pirated materials. Considering the fact that the Internet is not necessarily the end of the piracy distribution chain, it would be fair to assume that, for a given work, there will be more pirate versions of that work than the legal version. This can be demonstrated using a simple example.

Assume that 100 000 people legally download a song. Assuming that each of these consumers have two close family members or friends, a further 156 000 people will be given these songs by the original consumers (78% of respondents would share with friends and family). Since, half of the original consumers would not mind if friends or family redistribute the works, there is a very high chance that the song would make its way onto a p2p network, and then will be pirated by other consumers. Furthermore, a quarter of the respondents did indicate that they would distribute unrestricted works over the Internet themselves, thus the potential penetration increases substantially.

Even if the song is not released on a p2p network, it is highly likely that the friends and family will share the song with their own friends and family, who are likely to be different to the original purchaser. If only half of the new acquirers share with two further people, the number of non-purchased songs will rise to 312 000. This is over three times the number of the original songs sold. While we do accept that the chances of a pirated copy being available would increase on the popularity of the legal version, but the sale of a legal digital version does not have to be as high as a comparative physical medium to achieve the same level of market penetration. Thus, popularity and the market penetration of unrestricted digital music would not match the sales of the legal version.

Thus, there is still a need to use protection mechanisms like DRM, but these mechanisms need to take into account current usage patterns and expectations.

B. Attitudes and Experiences with DRM

30% of the respondents have interacted with DRM enabled works. Of these respondents, 46% of the respondents were not aware of the particular restrictions imposed by DRM systems, while 18% of the respondents were aware of the restrictions, but not informed during the purchase of the materials.

⁴We defined a fair price as “a price that you are willing to pay taking into consideration that the service and product has a cost and that the provider of the service and product wants to make money from selling you his product (or service).”

Another worrying factor is that a large number of respondents (30%) do not understand all the limitations carried by the DRM enabled file. A further 10% of the respondents only understand some of the restrictions placed on the file. In comparison to the INDICARE survey [12], these values are lower – in the INDICARE survey, over 70% of the respondents did not know or understand the limitations. In light of these results, it is not surprising to see some of the hostile reactions to DRM.

The respondents provided a number of different reasons on why they were reluctant to use DRM enabled media. These reasons included:

- 1) **Incompatible systems:** DRM systems are often restricted to particular operating systems, applications and devices. This alienates a number of respondents who would like to use programs and systems they are more comfortable with.
- 2) **Local unavailability:** Many respondents claimed that DRM enabled media was not available locally, or they did not know of any services offering DRM enabled media locally.
- 3) **Too many restrictions:** Some respondents felt that DRM had too many restrictions on what they could do with the protected work when compared to what they could do with physical media.
- 4) **Privacy concerns:** Some of the respondents fear the vendors and rights holders will track their usage of DRM enabled work. However, the INDICARE survey suggests that privacy is not a major concern for users [12].
- 5) **Expiry of restrictions** Some of the respondents were willing to buy DRM enabled works as long as the restrictions expired after a certain period of time.

V. DRM, COPYRIGHT AND LICENSING

In [10], Camp promoted the position that DRM does not imply copyright protection. This position was further argued by Arnab et al, and they proposed that DRM systems are in effect licensing systems [8], and interactions with DRM systems should be treated as such.

If DRM systems are to be treated as licensing systems, some of the fair use provisions in copyright law may not be applicable, and in some territories, like the EU, not applicable at all [2], [13]. Licensing, however is a contractual process, and DRM systems would thus need to enable users to create valid and legal contracts for them to be binding. Incomprehensible restrictions, non expiry of restrictions, non disclosure of incompatibility and privacy concerns need to be addressed before these systems can be considered to be legal.

In the next section, we discuss two DRM systems that we consider to be not legally compliant because they do not produce valid contractual conditions. We also discuss how these systems do not address user expectations or current practices, as discussed previously.

VI. ROGUE DRM SYSTEMS

Correctly implemented, DRM systems should have minimal effect on the user's enjoyment and standard usage practices. If they cannot do something they can do with physical media, they should be properly informed on this fact before they purchase the media. However, most DRM systems have very restrictive policies and, except for Apple's iTunes system, most of them do not cater for most user expectations [7], [18]. As discussed earlier, many users are not aware or do not understand the restrictions imposed by DRM systems. There is a third category of bad implementations, where the implementations themselves are harmful to the security of the user's computers. In this section we discuss two DRM system implementations, one failing to inform users and the second creating major security issues in user DRM systems.

These DRM systems create a negative attitude of users to DRM systems, and ultimately could cause the potential failure in acceptability by the wider consumer base.

A. *Vodafoneline!*

Vodafoneline! is a portal for most of the UMTS services that fall directly under or through subsidiaries of the Vodafone Group. In South Africa, the portal is administered and run by Vodacom. The portal provides a variety of services including music and video downloads for which the user pays a fee (debited to their mobile phone account). The content provided by the Vodafoneline! portal is protected using the OMA DRM 1.1 standard using the Forward Lock specifications.

The Open Mobile Alliance (OMA) is a consortium of parties interested in the mobile communications arena including service providers, network companies and equipment manufacturers. The OMA specifications are often implemented by its members, which ensures compatibility across the globe. For this reason, most modern mobile phones (from 2004 onwards) have implementations of OMA DRM 1.1, if they have the capability to render music and video content. The OMA DRM 1.1 specifications cater for three types of DRM specifications, increasing in flexibility and complexity in its implementation [19]:

- 1) **Forward Lock:** The protected content is locked to the consuming device and can be only used by the consuming device. There is a very limited set of rules (rights) that are implemented, and these are standard for all consuming devices implementing OMA DRM 1.1.
- 2) **Combined Delivery:** Like Forward Lock, the content is locked to the consuming device. However, unlike Forward Lock, there is flexibility in the rules (rights) that can be implemented, giving the rights holders a lot more flexibility.
- 3) **Separate Delivery:** The content is not locked to the consuming device, but to access the content, a separate use license needs to be acquired. The license is usually locked to the consuming device.

Despite marketing downloading of music tracks as similar to buying CDs, the Vodafoneline! system is different to consumer

	Usage Patterns / Legal Requirements	Vodafone!live!	SONY-BMG	iTunes	Traditional CDs
U01	Device Portability	N	N	Limited	Y
U02	Backup	N	N	Limited	Y
U03	Format Shifting	N	N	Limited	Y
U04	Relationship beyond Sale	Y	N	Y	N
U05	Long longevity of media	N	N	Unsure	Y
L01	Allow all aspects of copyright law	N	N	N	Y
L02	Detail all restrictions before purchase	N	N	Y	n/a
L03	Advertise restrictions during marketing	N	N	Y	n/a
L04	Provide notice of restriction	Y	N	Y	n/a
L05	Non Disclosure of Terms and Conditions	Arguable	Y	N	n/a
L06	Harsh terms of contracting (Consumer Affairs Act, Act 71 of 1988)	Arguable	Y	N	N
L07	Opportunity to review and withdraw [from a transaction](ECT Act - Chapter VII)	Y	N	Y	Y

TABLE I
COMPARISONS OF DIFFERENT MUSIC DRM SYSTEMS WITH TRADITIONAL CDS

expectations. In particular, despite a high rate of mobile phone replacement [16], the data is locked to the phone. Consumers that wish to play the same music file on their different phones, or migrate their purchase to different phones are unable to do these actions. However, as discussed earlier, consumers continue to use media for a long period of time and would thus expect the same from digital media, especially as there is no change in format.

But the biggest problem with Vodafone!live! is the lack of information regarding the restrictions. In the entire documentation, the restrictions are only mentioned once, and that is in the Frequently Asked Questions (FAQ) section under help. The restrictions are not mentioned in the terms and conditions during purchase, nor in the terms and conditions for use of the system listed on the main website.

As we have discussed previously, DRM is a licensing system, and thus sets out a contract between the consumer and the rights holder. For a contract to be valid, all the participants must be willing participants and they must be aware of all the terms and conditions of the contract [22]. While it is true that some terms and conditions can be implied [22], DRM is a new technology not well known to the public; and thus cannot be deemed to be implied.

In our opinion, the users using Vodafone!live! are not legally bound by the DRM restrictions. However, OMA DRM is almost impossible to bypass, and most common users will not be able to do so. Furthermore, because the cost of the content is relatively cheap, and due to the financial position of Vodacom as one of the biggest companies in South Africa, it would not be financially feasible for most users to argue the restrictions in court. Thus, even though the users have a legal right not to have their content restricted, they do not seem to have a recourse to bypass the restrictions.

B. Sony-BMG Rootkit

In October 2005, Mark Russinovich, a computer security expert at the USA based SysInternals wrote on his blog details on a rootkit installed by a copy protected CD published by SONY-BMG [20]. Rootkits are programs developed to bypass

standard operating system security protocol and interact directly with the operating system. For this reason, rootkits allow the program complete control of a computer, and depending on its purpose can allow hackers free reign on the target system.

While the SONY-BMG rootkit did not seem to grant access to hackers, it fundamentally changed the operation of Windows XP, and the operating system's control over the computer's devices [20]. Furthermore, the license agreement⁵ did not state that the nature of the program and its potential harm to the operating system of the user. In either case, it is highly likely that such a use license would be ruled invalid, if contested. In effect, the rootkit was no different to most spyware and a major security risk for affected users, and there were subsequent attacks that were made possible due to the rootkit [17]. Because there was no easy way to remove the rootkit, security measures had to be introduced to combat the potential effects of a rootkit in many companies [23].

While the SONY-BMG issue was subsequently settled out of court, it does raise issues relating to trade practices. Like Vodafone!live! customers, the consumers were not properly informed of the full implications of using the product.

C. Comparison to iTunes and Traditional CDs

Apple's iTunes Music service is currently the leading DRM enabled music distribution service, and accounts for the majority of legal online music downloads. Thus, iTunes is a natural comparison to the approaches discussed above. Comparisons between different DRM systems have been conducted before including [7], [18].

In table I, we compare how the DRM systems discussed in this paper, compare to iTunes and to traditional CDs, both in terms of usage patterns and expectations from consumers, as well as legal requirements. For the later, we look at a few requirements from law of contract as discussed in [22], the Electronic Communications and Transactions (ECT) Act of

⁵The complete EULA was subsequently posted by Mark Russinovich at <http://www.sysinternals.com/blog/sony-eula.htm> (last accessed: 2006-04-09).

South Africa [3], and current consumer protection laws. Some of the items are further detailed below.

L06 : SONY-BMG's DRM system causes undisclosed, un-repairable damage to consumer's operating system. Thus it can be considered a "harsh term of contracting". It can also be argued that Vodafoneline!'s locking of purchases to the mobile phone is a harsh term of contracting since cellular service providers promote frequent upgrades to mobile phones.

L07 : The ECT Act requires consumers to be able to review a product and withdraw from the contract if it does not meet their requirements. iTunes and Vodafoneline! offer a preview, but the mere act of inserting a protected CD into a PC running Microsoft Windows installs the software in SONY-BMG's case [20].

VII. FUTURE DIRECTIONS AND CONCLUSION

As we have established from our survey, there is a need to protect content on the Internet. It is however impossible to provide protected content under existing copyright legislation, and usage of licensing agreements is currently the only realistic direction. Considering the difficulty of protecting and enforcing digital copyright, the relevance of copyright laws to the digital medium needs to be questioned. Other than moral rights, copyright laws offer very little to digital media, and if rights holders wish to protect their works, licensing seems to be the only viable avenue. However, licensing agreements require the full participation of the user, which many DRM systems currently avoid.

DRM systems also need to provide a secure and seamless experience. DRM systems that create other security breaches, or lock users in with specific devices and applications will not have a broader market penetration acceptable to all. For this reason, there is a need to create a DRM system that is both interoperable, and seamless to the end user.

DRM systems also need to take into account the legal environment they are operating under. Current systems expose themselves to potential lawsuits with the propagation of invalid licensing contracts, and lead to user disillusionment. Even though the current market leader, iTunes, is not comparable to traditional CDs, it is much better compared to the SONY-BMG and Vodafoneline! DRM solutions. A comprehensive strategy is required to address all these problems before users will accept DRM.

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