

UNIVERSITY OF OSLO
Department of informatics

**The dynamics of legal and
illegal digital music
distribution**

Master thesis
60 credits

Christian Syvertsen

1.11 2007



1 Preface

This paper was written as a Master thesis in Informatics for Christian Syvertsen at the University of Oslo. The Master studies were started spring 2005, and the thesis is to be delivered November 2007. This Master thesis has been realized at the department of Information Systems at the Institute of Informatics at the University of Oslo, with great assistance and advice by supervisors Jennifer Blechar and Ole Hanseth.

2 Abstract

In this thesis I give an overview and background of the current digital music landscape, analyse it through Actor Network Theory and see the complexity of the network as making it difficult to break down into less holistic parts. Every part of the network influences the other.

As illegal downloads of illegally copyrighted music only increases, it seems apparent that the record industry have taken a wrong strategy. Copyright laws have been tightened, DRM systems have been applied and lawsuits have been made, but it seems that it has no decreasing effect on the illegal downloads. I believe what the record companies must to is to put more efforts into making a better legal music download service, that actually can offer a better product than the P2P networks, because then increasing numbers of users will prefer that legal alternative. But for something like this to be achieved, there is a long way to go.

Table of Contents

1	Preface.....	2
2	Abstract.....	3
3	Introduction.....	5
4	File sharing and the technologies used for it.....	19
4.1	Background on file sharing.....	19
4.2	How the file sharing networks work.....	20
5	Legal solutions for music distribution.....	24
5.1	Previous copy prevention measures.....	24
5.2	Digital Rights Management (DRM) systems.....	25
5.3	Other methods of possible control or surveillance of files.....	27
	Watermarking.....	27
	Acoustic fingerprinting.....	27
	Filtering.....	28
5.4	Monitoring and 'poisoning' file sharing networks.....	28
	Tracking of P2P files for promotional purposes.....	28
	Methods of P2P infiltration and sabotaging revealed.....	29
5.5	Interoperability and the digital audio player market.....	30
5.6	Current trend of moving away from DRM on music.....	31
5.7	The analog hole.....	32
5.8	The DMCA and Fair Use.....	35
5.9	Attempts at maintaining copyright on P2P networks.....	36
5.10	The online music stores and services.....	37
5.11	Online music distribution services for unsigned artists.....	39
5.12	Artists employing new distribution models.....	45
5.13	The issue of declining sales.....	48
6	Research basis.....	51
6.1	The problem at hand.....	51
7	Analysis.....	55
7.1	Introduction to ANT as a method.....	55
7.2	The actors in the network.....	56
7.3	Complexity of the network.....	66
7.4	A constantly changing network.....	67
7.5	P2P file sharing as a potentially disruptive innovation.....	70
8	Reflections.....	74
9	Work method.....	76
10	Conclusions.....	77
11	Literature list and references.....	79
11.1	Books and articles.....	79
11.2	Websites and pages.....	82

3 Introduction

In recent years a lot has been going on in the realm of digital music distribution and file sharing. All kinds of files can be shared on file sharing networks, but music files are currently the most popular, and it has a lot of industry buzz surrounding it. As people's Internet connections have gradually become faster over the last years, the sharing of video files (movies and TV shows) are also seeing an increase in popularity. Also, applications, computer games and e-books are being shared. However, the focus here is going to stay on the distribution of music, how it has evolved and to look at the dynamics between the legal solutions and the illegal file sharing networks. This is not only because of music sharing's current popularity, but also because other media types might follow in its evolutionary footsteps.

The original file sharing networks that became popular with the masses, such as the original Napster, only let the users share music files, and nothing else. However, this grew to be a massive success, until they eventually got caught up by the US copyright law. After the rise of new file sharing networks, such as FastTrack (Kazaa), eDonkey and Gnutella, and more lawsuits, the music industry subsequently agreed with Apple and their iTunes store, and subsequently to many others using (and licencing) Microsoft's WMA format, to distribute music files online on a large scale. One thing the major record companies demanded when selling their music files was that the files sold should be encrypted with DRM

systems, allowing them to limit and control how the person who bought a music file could use it.

The record industry originally tried to fight file sharing by lawsuits, in order to protect their existing business models. What the industry failed to do, however, was to actually compete with the file sharing networks. They created solutions that best suited their own interests, and not necessarily in the best interest of the consumers. The industry have always relied on formats without any copy protection, so why begin now? A huge majority of the unencrypted music files shared on file sharing networks come from ripped CDs, and not from removing the DRM from the encrypted music files. Also, people have become used to being able to share music with friends, at least since advent of the music cassette in the 1980s, and maybe even before. Not only are these old habits hard to break, but they also seem unnecessary to break, as the DRM often implied more restricted use than what customer expects when buying music. A study by Deirdre K. Mulligan et al. from 2003 showed that the copyrighted content on legal, DRM-based music services did not behave in a way that complied with the consumers' expectations for copyrighted music, and when compared to traditional formats such as the CD it was more restrictive [30].

History and background

People have made copies of music, primarily to and from their friends, ever since technology for it has been available. And as new technologies that enable copying in some form has emerged, the music industry has always tried to find counter-

measures in order to stop or limit it, in order to protect their property and that of their artists, and also to retain their current business model. When home tape recorders for music cassettes became popular in the 1980s, the music industry feared it would cause a decline in record sales. The British Phonographic Industry even launched a campaign against copying with the slogan “Home taping is killing music” [49]. Before the CD format was launched, an inherent copy protection scheme for it was discussed, but was found unnecessary at the time, a decision (at least parts of) the industry have later have come to regret. When CD burners were introduced, the ability to make perfect digital copies of the music were made available to the public, and the industry again feared the record sales would suffer, but no conclusive evidence for that was produced.

The ability to transfer and compress audio from CD's into computer files (commonly referred to as “ripping”) was made popular with the MP3 (MPEG Layer 3) compression format, developed by the Fraunhofer Society, when the first encoder for it appeared in 1995. The format became more popular with the release of Nullsoft's Winamp MP3 player for Windows, released in 1997, and also the mpg123 player for Unix platforms [31]. But more importantly, the compression of the audio meant that we got much smaller file sizes than without compression, and smaller files meant that it was ideal for users wanting to share their music, also making it ideal for file sharing networks.

Though it had been possible for friends to share their music previously, through copying each other's music cassettes or CD's directly, the Internet provided a

solution that meant that did neither require you to buy the music yourself or borrow it from a friend. If anyone in the world connected to this network shared the file with the song you wanted, you could just download it, and you were all set. You didn't have to own or know someone who had the physical media container in order to make a copy anymore.

The sharing of media files has reached enormous proportions since the introduction of file-sharing networks in the late 1990s. Particularly it was the peer-to-peer network file sharing program Napster that triggered this development when it was released in 1999. The program allowed users to share their music files with others using the program over the Internet, and while the number of users increased, the number of shared files also increased accordingly. This program was the first that introduced file-sharing to a mass audience, and also initiated a change in the way the Internet was used.

However, the vast majority of the files shared on this network was in fact copyrighted works, and thus illegal to share. In the light of this, Napster did not become a popular program with the rights holders, i.e. the record companies and the music industry. A lawsuit against the service was made by the RIAA (Recording Industry Association of America) on behalf of its members a few months after its launch, in December 1999. This lawsuit dragged on for quite some time, and drew a considerable amount of publicity towards Napster, particularly with the RIAA commenting that it was a “haven” for digital music piracy on “an unprecedented scale” [29]. The service was eventually shut down in July 2001, in

order to comply with the court's decision. However, Napster eventually re-emerged in a drastically different form as a legal service in 2003.

Of course, there had been a piracy scene even before P2P networks saw the light of day, but P2P services brought all kinds of files (media, applications, games etc.) out to the masses. Before this, file sharing was more “underground”, to a large degree based on closed networks with FTP servers, or by using the Usenet (a newsgroup discussion network system), but that never got the mass appeal of the P2P networks.

The music industry had hoped that the shutdown of Napster would signify the end of file-sharing, but time would prove them very wrong. As the technology of the service was already developed, there was no way of “letting the cat back in the sack”, and thus, new and more advanced file-sharing services eventually were developed.

One of the primary reasons why Napster could be “taken down” through legal action was the fact that it stored its directory of files available for download centrally on a server, although the actual files were stored on other users' computers [32]. The services that emerged after Napster was shut down had learned from this fact, and utilized other solutions to avoid the ramifications of the law. The Gnutella network already existed at the end of the original Napster's lifespan, and that together the FastTrack network, with client software such as KaZaA, became the new networks of choice for file sharers. A number of smaller

networks also surfaced, and most of these networks did not have a restriction to the type of files that could be shared, which meant that not only music, but videos, documents, applications, games and images was available for sharing.

These networks lacked a central server that directed the users to the files, which meant that they were much more robust than the Napster network, where you simply could remove the server to make the entire network collapse. The architecture of the Gnutella network was based on “distributed queries” where the user searches are conducted by first querying the closest few nodes, which checks if they have the file, and if not, they query their closest nodes, continually expanding the search until the file is found. This model worked well with smaller networks, but when the Gnutella network grew larger, it used a lot of bandwidth, the searches went slower, and it generally couldn't scale well when the user mass increased [33]. Thus, it eventually lost large parts of its user base. Clients that used the Gnutella network includes Bearshare, Gnucleus, Limewire, Morpheus, WinMX and XoloX [34].

In the FastTrack network the tasks of the central server had been handed out to specialized computers in the networks that can be called “supernodes” or “superpeers” [45], which makes file lists from the nearby nodes, and when a search is done, the closest supernode is contacted, to check if the searched file is on its list, if not, the search query is forwarded to the next supernode, and if the file is found on its list, a connection between the nodes can be established for downloading.

The most successful client for the FastTrack network was Kazaa, which reached enormous popularity. FastTrack had no similar scaling problems like Gnutella, so Kazaa actually went on to become the world's most downloaded software, with over 389 million downloads [35]. In October 2001, the RIAA (Record Industry Association of America) filed a lawsuit against another client for the FastTrack network, Grokster, on the grounds that it was being used for sharing copyrighted works.

Some of the lawyers (most notably Fred von Lohmann) that defended Grokster in the case were from the EFF (Electronic Frontier Foundation), an organization that is dedicated to the preservation of free speech rights in the digital age [36]. They argued their case with two key arguments. The first was based on the precedence created with the Sony Betamax case in 1984. The U.S. Supreme Court decision in this case was that the Sony VCR (Video Cassette Recorder) was legal, even though it might be used for copyright infringing purposes, as long as it also had “substantial non-infringing uses” [37]. Since Grokster used a general purpose technology, and (unlike Napster) was under no centralized control, the two cases had many similarities.

The other main argument was that technological innovation should not be stopped because of copyright regulations. They argued that an important new technology should not be hindered by trying to uphold the industry's business model, and that copyright law had been flexible enough to change, and permit new technologies to

come to market in the past, and that this still should be the case in this digital age.

In April, 2003, the court ruled in favour of Grokster. RIAA appealed immediately, but their appeal was turned down. However, they had support of some prominent senators, and had not given up the fight. In December 2004, the Grokster case was appealed again, but this time to the Supreme Court. In the meantime, however, the RIAA decided to sue some of the individual file sharers (and potentially their own customers). This resulted in a few press stories about grandmothers and little girls being sued for extremely large amount of money, and did not go down well with the general public [92]. However, it also scared a lot of people away from using file sharing applications. RIAA has continued with this practice to this day, and they have showed no sign of slowing down yet, also by sending so called threatening “pre-lawsuit notices” particularly to US college students [93]. EFF lawyer Fred von Lohmann has commented; “I think this really suggests that the recording industry dinosaurs have completely lost touch with reality – over 57 million Americans are using file-sharing software today. That's more than voted for President Bush” [38].

In the summer of 2005 the RIAA finally got the result they wanted in the Supreme Court; the lower court's decisions were reversed and the business model of the companies with clients for the FastTrack network were deemed illegal; in the sense that they were premised on an obvious intent of encouragement to break copyright law [38].

Already before this, Kazaa and Grokster had trouble with a massive number of fake or corrupt files on the network. Kazaa also lost dramatic numbers of users when trying to use advertising in the client, but they had great difficulty attracting enough respectable advertisers, and were “forced to” turn to including ad-ware, and even spyware. Grokster announced its shutdown November 2005, and in a settlement Kazaa agreed to pay \$100 million in damages to the four major music companies (EMI, Warner, Universal and Sony BMG) as well as an undisclosed figure to the motion picture studios, and additionally agreed to turn Kazaa into a legal service [39].

Many other file sharing clients also were shut down as a cause of the decision that was made in the Grokster case, including eDonkey. As networks become marginalized, fewer users means less content, and less content means users will turn their attention elsewhere, either to other hard-to-discover “darknets”, to legal digital music pay sites or to the physical record store. However, the eDonkey network still exists today, as well as other file sharing technologies such as BitTorrent and Direct Connect.

The website for the eDonkey2000 P2P network was closed down in September 2006, after their owners, MetaMachine, agreed to pay a \$30 million settlement over a copyright lawsuit by six record companies, under the ruling that they enabled users to share copyrighted media files illegally [26]. However, although

the website is closed down, and new versions of the original eDonkey2000 client is no longer being developed, the network still exists and can be accessed through other clients such as eMule and Shareaza [28]. Another P2P service, Morpheus, was also closed down in the same month.

In October 2007, popular invitation-only BitTorrent tracker Oink.cd had its Dutch-hosted servers raided and its administrator arrested in England, after a police investigation initiated by IFPI and BPI (British Phonographic Industry), on the grounds of sharing music files before their official release date.

However, many of the files on that network contained music that was hard to obtain, or out of print, in high quality versions [50, 51]. This addresses an advantage with digital distribution; files never expire, nor go out of print, and are always available.

BitTorrent has been gaining popularity since it was established in 2004, and is now the most widespread file sharing technology. It is a sort of P2P network that specializes in the transfer of large files, so videos and applications are popular to download, in addition to music. It does not have client applications where you can search for files, but instead requires the user to enter a website that holds links to the available files on the network. One of the most popular of such websites, and the one that has gotten the most media attention is The Pirate Bay [94], based in Sweden.



Fig. 1: The Pirate Bay logo

Apple's iTunes store and the legal alternatives

Although the major record companies had launched two different online music stores before, none of them were successful at all. So when Apple launched its iTunes store on April 28, 2003 in the USA, the general expectations were not high. This was the first fully legitimate solution for music distribution over the Internet that was not run by the record companies. The iTunes store did not work as a file sharing networks at all, it's built on buying songs and downloading them from centralized computers.

Apple had brokered deals with all the major record companies to allow them to sell and distribute their copyrighted songs this way, signalling the first step of willingness to change by the record industry and the RIAA. However, Apple had to pay the record labels a licensing fee for permission to sell their products.

Compromises made in these deals meant that their pricing should reflect the price the labels were charging for physical CD's, but they did price their songs at \$0.99, low enough to be an "impulse buy", as Apple CEO Steve Jobs put it.

A more significant compromise was the inclusion of a DRM system in the music files. The intention of this was to allow personal sharing of the music, but not allow the mass sharing through file sharing networks. The DRM limited what the users could do with their files, such as the number of computers it could be used on and how many CD's you could burn with a specific play list, and it also left Apple with considerable control over the files, as they could, if they wanted, change the terms of the DRM at any given time.

Competing with the file sharing networks

With legal music file distribution, a new type of Internet service was launched. A legal alternative to the file sharing networks had finally emerged. But how would it compete with the file sharing networks, who offered songs for free, and without DRM encryption? Thus, at launch, many were sceptical to its success. But iTunes did have something the file sharing networks didn't; it was a legitimate service, and there was no risk of lawsuits. Also, the song files from iTunes store were reliable downloads, in the sense that there were no corrupted files, as P2P networks had been plagued with at the time. These arguments were persuasive for a lot of people, as iTunes store did become quite successful, and multiple other legal download stores were eventually launched.

Interoperability

However, there are major interoperability issues with DRM files bought from the iTunes store and other legal services, deriving from the DRM system. They can

only be played on a limited number of computers, but in terms of portable (physical) music players, files bought on iTunes are *only* playable on Apple's own iPod, hence locking in the consumer to that piece of hardware for that type of use. Apple only sells music in the AAC format, implemented with FairPlay DRM system through the iTunes store. Most other legal stores uses the WMA format with DRM, licenced from Microsoft.

While Apple's iTunes and stores using WMA with DRM sells music from RIAA-associated record companies, there are also a few online music stores that sells files in un-encrypted MP3-format (eMusic being the most popular), but these stores only sell music files from independent record companies not associated with the RIAA. Other solutions, such as Magnatune, have their own business model for distributing music by artists not associated with any record labels, by enabling users to listen to full songs and albums for free, and letting the users decide the price if they want to buy the music.

People who shop at the legal digital music stores shop there because they want to pay for their music, not because they are unaware that file sharing networks exist. What needs to be realized is that the DRM used only hinders their paying customers, the pirates get their music files from other sources anyway. By integrating DRM in the music files they hinder customer control, and that can actually reduce the value of the product they are selling in the market, again reducing customer demand and price [40].

EMI begins to sell music files without DRM

EMI, member of RIAA and one of the four major record companies (along with Warner, Universal and Sony BMG) experimented with sales of unprotected MP3 music files from their catalogue through Yahoo's music service over the past year . After Norah Jones' single "Thinking About You" did "very well" through this service, music general manager at Yahoo, Dave Goldberg, stated "The MP3 certainly didn't hurt [her album sales]". Recently EMI announced that they would dramatically shift their strategy, and have had negotiations with sites such as eMusic and Yahoo music to distribute at least parts of their catalogue as unprotected MP3 files. The other major record companies are, at least as of yet, still opposing selling music files without DRM, although Universal has also been conducting experiments. However, we are now in a period where things are changing fast, and many believe the rest of the industry will follow, at least if EMI is successful with this venture [95].

4 File sharing and the technologies used for it

4.1 *Background on file sharing*

Although seen as the big bad wolf by the music industry, the file sharing networks themselves are not illegal, but the technology and infrastructure they are based on provides a possibility for the sharing of all kinds of files, also including illegally spread material.

The main problem the music industry has had with these networks is that the means of control of the files therein is virtually non-existent. In fact most of them have been designed to prevent control, or to spread the control out to its users.

The focus of the file sharing networks, and the applications and clients used to access them, have gradually shifted from just offering a good solution for offering, sharing and downloading songs, to more stealthy, encrypted networks that e.g. can be used to avoid censorship in certain countries.

Most of the file sharing networks that have existed, are classified as a form of peer-to-peer (P2P) network. There are again numerous classifications of these P2P networks, primarily based on their technological differences.

4.2 *How the file sharing networks work*

The first generation of file sharing networks, such as the original Napster, used a “central indexing server” [32] where information on which nodes had the file that was searched for was stored. According to some definitions [100] this type of network is not strictly a P2P network, because of the reliance of a central server.

In the second generation of P2P networks, so-called “super-nodes” [45] took over the role of the central indexing server, and essentially spread its tasks on to specialized nodes in the network. If a search from a node (user) yields no results on the closest super-node, the request is passed on to the next, until a hit eventually is found, and a connection between those nodes gets established. The most widely used networks of this type has been the Gnutella and FastTrack networks, the latter particularly well known through the Kazaa client application.

The third generation of P2P networks uses no file lists and no information on the placement of files on the network. The contact between the nodes relies on “distributed requests” or “distributed searches” where when a search is performed, the closest nodes are being checked, and if they don't have what you are searching for, they move on to check for it on their closest nodes, and so on.

Second and third generation networks are also by design very hard to shut down, because of the fact that they have no central server. Einhorn sees the 2nd and 3rd generation (or layer, as is the term he uses) as as one and the same. Contact

between the nodes are made by IP addresses, which enables the identification of the users technically [46].

In Europe, in order for media businesses to make this happen in practicality, however, a criminal case must be made [41]. However, the International Federation of the Phonographic Industry (IFPI), representing the worldwide music industry [43], as well as organizations administering musical performance rights in some European countries, such as TONO in Norway, have proposed that they should gain direct access to IP addresses from the Internet Service Providers (ISP) bypassing the need for a criminal case [42]. The Norwegian proposal for this has been met with much criticism.

The fourth generation of networks are currently under development or in beta versions, and these focus on maintaining full anonymity and freedom from censorship.

Files on such networks are encrypted, split up in pieces and stored on a large number of nodes. Because of this, even the users doesn't know what they store on their own computer. Everyone that is a part of the network distributes data, which eliminates so-called "leeching", ie. that someone on the network can get the advantage of using the network, but not giving anything back to the network [47].

Freenet is the most important fourth generation network, and Einhorn [46] considers it the only fourth generation (layer) network. Other networks that has

been categorized as fourth generation include GUNet, I2P and ENTROPY [45].

Some second and third generation networks have also included anonymization techniques used in 4th generation networks.

The BitTorrent protocol and networks have been classified as second or third generation, and is reliant on indexing websites for users to find their files. It uses a central location to manage people's downloads (known as a tracker) but it does not store the files the users are sharing. The BitTorrent protocol works in the way that you upload at the same time as you download, as the files you download are split over many computers who also download and upload simultaneously, sharing the burden, so to speak.

Friend-to-friend networks [48] were developed with the focus on security and anonymity by restricting access to whom you specifically grant access, and by using encryption (and other elements) for this purpose. The structures are based on second and third generation P2P.

Also, so-called Darknets are similar to friend-to-friend networks, but it can also be used to describe private P2P file sharing networks. It is a closed virtual network that can be used for any type of communication, but file sharing is the most common [101, 102].

Although P2P primarily is used for file sharing, a number of other services utilizing

the power of P2P networks have appeared. Internet phone and chat service Skype and streaming TV service Joost uses P2P networks for their operation.

5 Legal solutions for music distribution

Many different legal online music distribution services are available now, but most of them use the same *modus operandi*. The company that runs the service licences the songs and albums they wish to sell via their online store, through deals with the record companies and/or organizations that act on behalf of the record companies. The world's four largest record companies; EMI, Warner, Sony BMG and Universal, have during the negotiations for the deals been very clear on the need for protecting the music files from unlawful copying. All the music owned by the record companies is protected by copyright, so this naturally applies to the files as well.

However, not all record companies embrace the idea of protecting their music files. Most independent companies do not demand that their files should be protected. 'Independent' in this context means that they are not members of the RIAA (Recording Industry Association of America). Services that offer music files from these companies, such as eMusic, often offer them in unprotected MP3 format. Also, quite a few new services for unsigned artists have emerged.

5.1 *Previous copy prevention measures*

Previously measures to protect from copying from physical formats had never been implemented on the full-scale level of digital music files. In the 80's, music cassettes had a physical copy prevention measure, but it was extremely easily

bypassed by putting a small piece of tape on each of the two small holes on top of them. Sony, Warner, Universal and EMI incorporated copy prevention systems onto a great deal of their CD releases, but it seemed to do more harm than good, seemingly both to the record companies (in the form of bad publicity) and to consumers (in the form of restrictions of use, or not being able to use the discs at all).

While the record companies' intentions might have been fair, the discs with these systems more than a few times wouldn't play at all on some CD players (due to the fact that these discs were not made in compliance with the official Red Book CD standards, thus could not officially be labeled as proper "Compact Discs". Also, some of Sony's releases came with the now infamous XCP copy prevention system, which installed a malicious rootkit software on the computer it was played on [6]. Another flaw with these systems was that they were generally relatively easy to circumvent, in the case of the Copy Control system one could simply avoid it by turning off the "autorun"-feature or holding down the Shift-key on Windows computers. Eventually, the CD copy prevention systems have been phased out, with EMI the last to abandon the Macrovision-developed Copy Control system in late 2006.

5.2 *Digital Rights Management (DRM) systems*

The acronym DRM, short for Digital Rights Management, generally describes the different types of measures for controlling access to copyrighted works. Because of the measures' often restrictive nature for the end user, some critics feel the

acronym should spell out Digital Restrictions Management instead [23]. Using DRM schemes was seen by the record industry as the ideal solution for protecting the music files. There are many different DRM implementations, often custom made for the media type they are meant to protect. In the context of digital music, the purpose and function of a DRM system is to authorize or control different aspects of the playback of the music files. Many different types of restrictions are possible, but the most common are variations of these;

- limiting the number of times a file can be played or setting a time limit where a song can be played any number of times before it “expires”, ie. playback is denied
- limiting the number of times a file (or a group of files, often in a set order, like an album) can be burned to CD
- limiting the number of times a file may be copied to a portable device
- limiting the number of computers a file may be played on simultaneously

Other types of restrictions also apply, but these are not restrictions set as parameters in the DRM system itself. These are caused by the proprietary nature of the DRM system, and leads to the restriction of playback only on players or devices specifically designed to support that particular DRM implementation, and as a result, interoperability suffers. The most common example of this is that protected files bought on the iTunes music store are only playable on Apple's own iPod media player (or on the iTunes player application for computers).

5.3 *Other methods of possible control or surveillance of files*

Watermarking

The creators of a file may choose to embed information into a file, which may or may not be visible or audible, depending on the type of file. Watermarked images, for example, may have a logo on them to signify the ownership of the image. If watermarking is used in legally bought audio files though, the additional information stored in the file should be inaudible.

All songs downloaded from the iTunes store have a watermark (Apple ID), that stores information about the customer.

Acoustic fingerprinting

Acoustic fingerprinting is a technique to generate a unique code from an audio waveform (the shape or form of an audio signal) in order to identify or categorize audio samples. It has numerous uses, but the most relevant in this case is the ability to identify pieces of music (songs), as well as monitoring the files that appear on a P2P network. Depending on the quality of the algorithm used, the recognition of songs should work properly even if they are in different formats and have a different compression rate [20].

Filtering

The identification of files on P2P networks, through various algorithms, can also be used for filtering out unwanted files on a network. The filtering process would be extremely dependent on the correct identification of the files; which again could prove very difficult if the P2P network used a robust encryption scheme for its files.

The reasons for filtering out files can be to “clean up” P2P networks at the request of the major labels, by identifying their content and making a solution to pay for that, while also removing or hiding all other content. The task of 'cleaning up' the networks could fall on the ISPs. Such tasks, however, would be much easier in a start-up P2P network where the content that is shared on the network can be controlled and restricted more effectively.

5.4 *Monitoring and 'poisoning' file sharing networks*

Tracking of P2P files for promotional purposes

Record companies hire the services of companies such as BigChampagne [52], who tracks digital media on the Internet, and particularly on P2P filesharing networks. The record companies can then use the acquired data to gain knowledge on which artists and tracks to promote in other channels, such as influencing radio stations to play it more. BigChampagne also compares cipher codes from the IP addresses of downloaders to US zip codes, to differentiate which regions there are more of a demand for certain tracks or artists. This area

tracking is based on static IP addresses though, and dynamic IP addresses are simply attributed to national data. Record companies (and other media companies) are reluctant to admit their relations with such media tracking companies publicly, both for public relations and legal reasons. According to BigChampagne, their customers include the Warner Bros., Atlantic, Interscope and Elekta record labels [16].

Indirectly, through their actions, the record companies are thereby admitting that there are other uses of the file sharing networks than breaking copyright laws, and that they can harvest significant and relevant marketing data from this, as well as promotion in itself. As the large record industry labels and organizations as a whole are also fighting the file sharing (and copyright infringements) on these networks, this might appear somewhat contradictory. However from a purely business view, it is not so strange they are working for their interests at both sides, as piracy is highly unlikely to go away in the near future in any case. Exactly how cost beneficial the data the record labels get from media tracking companies remains undisclosed, but it's nevertheless interesting and undeniable that these data *are* in fact valuable for media companies.

Methods of P2P infiltration and sabotaging revealed

MediaDefender [58], a company that has specialized itself on infiltrating and sabotaging file sharing networks, suffered a leak in September 2007, when almost 700 MB of company internal e-mails was distributed publicly on a BitTorrent network. These e-mails revealed that MediaDefender had been behind a video

sharing site (www.miivi.com, currently unavailable) that was designed to trap uploaders of copyrighted content, a claim they had publicly denied some months before. The e-mails also revealed that MediaDefender is working on a project to allow US government offices to directly access their data on P2P users. Source code for many of MediaDefender's anti-piracy programs has also leaked and been released on BitTorrent networks [59, 60, 61].

Based on what was revealed in the leaked e-mails from Media Defender, Sweden-based BitTorrent tracker site The Pirate Bay has claimed media companies are responsible for infrastructural sabotaging, denial-of-service attacks and hacking on a commercial level, and has reported a number of these companies, including the regional branches of EMI Music, Universal Music Group, and Sony BMG Music to the Swedish police. The result of this is not yet decided at the time of writing.

5.5 *Interoperability and the digital audio player market*

Apple and Microsoft are the major actors in this market. Apple has released their iPod music players all over the world, whereas Microsoft's Zune music player, is only for sale in the US at the time of writing.

Both companies use the strategy of trying to create a lock-in for the user to their products by tightly integrating an online music store with the portable player, and locking their formats to the players using proprietary DRM systems.

In other words, the DRM-protected songs (in AAC or WMA formats) bought on the

parent companies' music stores are only compatible with that company's physical music and media players. However, both the iPod and Zune also support the unprotected MP3 format.

Several European governments have opposed Apple's Fairplay DRM system used on the iTunes store, and the fact that music files with this DRM system only can be played back through the iTunes application on computers or on Apple's own iPod portable music player, claiming it reduces interoperability, as Apple have decided not to licence out the use of their DRM system (as opposed to Microsoft's more liberal licencing strategy) [66, 67].

This tight integration produces a lock-in, but that *can* also make it easier to produce a more user-friendly system for the consumers.

5.6 Current trend of moving away from DRM on music

Although the major record companies, supported by the RIAA and IFPI, have been stern on the point of needing DRM, EMI has changed their position on the need for protected files, after a successful experimentation period, when they offered Apple to sell a great deal of their artists' music without any DRM systems, in unencrypted AAC format, through the iTunes store. These files have a higher bitrate than the standard AAC formatted files on Apple's service, and have also been made slightly higher priced than the standard files. This change was apparently triggered by, or coincided with, Apple CEO Steve Jobs' speech entitled "thoughts on music" [96].

However, as with the standard AAC files with DRM on iTunes store, the DRM-free AAC files does have a watermark (called Apple ID) that identifies the buyer of the file.

As the first of the major record companies to release tracks without DRM for sale, EMI experienced an initial increase in digital music revenue of 26%. However, this is a figure lower than Warner Music Group's increase of 29%, and much lower than Universal's increase of 49% for the same period, both of which sell their tracks with DRM. These numbers put into question whether or not there is an actual comparable increase in sales because of the lack of DRM on EMI's tracks, and might lead to the continued use of such systems on digital music by the other major record companies [97, 98]. However, EMI's DRM-free tracks on the iTunes store were sold at an increased price through the iTunes Plus service, which may well have influenced sales negatively. Still, according to a European market research survey from Berlecon Reseach and INDICARE, people are actually willing to pay a much higher price for DRM-free music purchases [99].

5.7 The analog hole

When the big record companies began integrating copy prevention systems on CD's in 2001, it was seen as a response to the declining record sales thought, at least by themselves, to be caused by the illegal file sharing.

Presumably, the reasoning was that the music files on file sharing networks originated from (ie. were ripped from) unprotected CD's. Thus, it seemed like a good idea to protect these CD's from being copied or ripped to an unprotected media file format such as MP3.

Keeping in line with this way of thinking when deciding to sell their music files online, also protecting these files seemed like a good idea. There are currently two predominant DRM schemes used for copyrighted digital music; Apple's FairPlay system and Microsoft's Windows Digital Rights Manager [1]. Apple's system is applied only on AAC-formatted files on the iTunes music store, whereas Microsoft's system for WMA-formatted files is licensed out to a whole host of online music stores.

However, all of these copy prevention schemes on music files had a couple of inherent flaws that allowed for an easy bypass of them. The protected digital song files could be burned onto a CD, and thus removing the restrictions. The content could again be ripped from the CD back to the computer, now in an unprotected form, having lost its DRM protection system in the process. This method could however be stopped by imposing a rule in the DRM system that did not allow copying to CD at all. However, one could also use recording software or external equipment to record the audio stream via the computer's sound card while playing back the protected music file(s), thus making the recording unprotected. The quality of the new copy would however be slightly inferior from the original because of the conversion process, depending on the equipment used for it.

It was the Motion Picture Association of America (MPAA) first popularized the term “the analog hole” for describing the latter process of conversion in 2002 [4], as this is a process that is not exclusive to audio, but everything that can be converted from analog form into digital form, including video.

While the DRM on music files from Apple and Microsoft allow to user to burn music to CD's (albeit a limited number of times), thus enabling the possible exploitation of this technique, it has primarily the American motion picture industry that has been advocating the need for “plugging the analog hole”, even if the technology can be used for both video and audio. They have pushed forth for a legislation that can put an end to it, and in December 2005 the Digital Transition Content Security Act [7] was proposed as a bill in the US. The MPAA naturally applauded it, but it has come under much criticism from scholars in the field, including president and co-founder of the non-profit lobbying organization Public Knowledge, Gigi Sohn, and the writers of the Freedom to Tinker weblog, including Princeton University professor Ed Felten.

The bill would demand for new content protection technologies to be integrated into almost all analog video devices (ie. they would have to be redesigned), and one of these technologies (called VEIL) are being kept secret unless one pays a fee of \$10,000 to the private company who developed the technology and promises to keep quiet about the specifications. Thus, Felten calls this a “secret law” [8]. It is as of yet uncertain whether or not it will be ratified, as it is still

pending. Before passing a law on a secretive technology and requiring that to be integrated into millions of pieces of video equipment, which additionally will limit the users' ability to make legal copies that was stated as "Fair Use" in the Digital Millennium Copyright Act (DMCA), the governmental bodies should at least think twice, as it seems the critics have some valid points. As yet, no other countries have passed any similar laws.

This situation could be easily transferable to the music landscape, where it would mean that technology for control could be placed on future sound cards in computers. This leans very much on a Trusted Computing line of thought.

5.8 The DMCA and Fair Use

The Digital Millennium Copyright Act (DMCA) was passed as law in 1998 in order to criminalize circumvention of DRM implementations and also circumvention of access control (to copyrighted content) measures even without infringing copyright, as well as the production of technologies that are used for these purposes. It integrates two treaties from the World Intellectual Property Organization (WIPO), a specialized agency of the United Nations that has the stated purpose "to encourage creative activity, [and] to promote the protection of intellectual property throughout the world" [22]. This law made it possible for the record industry in the USA to send subpoenas to ISPs to get the names of the individuals who had downloaded illegal files, making it possible for them to pursue lawsuits against them. Both the RIAA and the MPAA had lobbied extensively to ensure that this law came into being, as they felt they needed more than just DRM

systems to protect their works on the Internet. However, with this law they failed to address the P2P file sharing services that were already there, where unprotected files were spread by the numbers on a daily basis. Still, in 2001, the EU Copyright Directive was passed, and it had many similarities with the DMCA.

The question of fair use has been much discussed within the context of digital music. The term is used to specify uses of copyrighted materials that is considered to be “fair” and non-infringing, even without direct permission or objection to the use from the copyright holder, and it is a central principle in US copyright law [68].

5.9 *Attempts at maintaining copyright on P2P networks*

In 2004, Sony BMG and P2P service Grokster were in talks about developing a P2P network that maintained the interests and rights of the record companies and the rights holders. It was supposed to be called Mashboxxx, until someone picked up the rights to the relevant domain names before Sony BMG and Grokster. Mashboxxx was rumoured to include SNOCAP's fingerprinting technology.

Grokster, also in 2004, launched a P2P radio service called Grokster Radio, in conjunction with Internet radio company Mercora. Grokster had “gone legal” at this time, but they still were shut down a year later by a RIAA lawsuit.

5.10 The online music stores and services

There are two primary models of service for the online music stores that feature major-label content; pay-per-download (also called the “a la carte”-model) and variations of subscription models, or combinations of the subscription and pay-per-download models.

Apple's iTunes Music Store

The original pay-per-download service. Does not have a subscription service.



Figure 2: Apple's iTunes store

Microsoft's MSN Music and Zune

The MSN Music store was launched in 2004 in order to compete with Apple's iTunes music store. The store offered downloads of individual songs for similar prices of iTunes, but in Microsoft's own music format WMA.

In the USA, MSN Music discontinued its download service on November 14th, 2006. Instead, it redirects the user to either Rhapsody or Microsoft's new service/platform Zune, released in the USA the same day. In other countries, the download service still currently exists, as Zune, the service, is tightly connected to the physical portable music and media player of the same brand, which is yet to be released outside the United States [2]. The streaming music service has been replaced by an Internet radio and music recommendation service under the name MSN Radio, provided by Pandora. This service is free, but with advertisements, or one can pay a subscription fee to avoid the ads [3]. Zune supports only playback on its own brand player and in Microsoft's own operating system Windows.

Rhapsody

Run by RealNetworks, this service offers streaming of its music library for a monthly fee, and both streaming and unlimited song downloads for a slightly higher fee. It also allows you to listen to (stream) a limited number of songs (currently 25) for free per month [5]. All the songs on Rhapsody are encrypted with their own Helix DRM system. Rhapsody is currently only available in the USA.

Yahoo! Music

Has both individual downloads, streaming and subscription services available, and uses WMA files with DRM for its downloads.

Emusic

Offers unencrypted MP3 files in package deals, you can order a set number of

songs to download whenever you want.

Napster 2.0

The legal version of Napster has only the name in common with its earlier namesake. Offers subscription deals and streaming.

AllOfMP3.com

A Russian site that utilized a loophole in the Russian copyright legislation to sell very cheap legal downloads. The RIAA tried to close it down through lawsuits, but failed due to the fact that AllOfMP3 was based in Russia, and thus US legislation did not apply to the site [27]. Due to international pressure from trade organizations however, it was recently closed down. The site allowed users to find the songs they wanted, then select the format and quality of the music file. For a better quality file, the cost was slightly higher. The user 'ordered' the file he or she wanted, then the file was converted from a source material to the desired format and quality, and sent to the user.

5.11 *Online music distribution services for unsigned artists*

There are also a number of new services available for new, unsigned artists to directly distribute their music online. These require the artists to already have recorded the music they want to sell or share freely, and thus bypassing regular record companies. All of these services initially only features unsigned bands and artists, and offer their files in the unrestricted MP3 format. Many also have different pricing schemes than ordinary music stores. Below are descriptions of some of the

most used, and most innovative services.

AmieStreet (www.amiestreet.com)

Uploaded songs are initially free to download for the consumer, but as more people download and recommend it, the price of the songs goes up. All songs are without DRM, in the MP3 format. The service is free for the artists who upload songs [9].

CDBaby (www.cdbaby.com)

CDBaby is a distributor for artists, that both sells CDs and distribute digitally to a host of online music services; including iTunes, eMusic, Zune, Rhapsody and Snocap. The artist needs to pay a membership fee, but keeps up to 91% of the income on the distributed songs [10].

eListeningPost (www.elistingpost.com)

This service allows artists to upload files and sell them as protected WMA or RealMedia files, or as unprotected MP3 files. The protected "preview files" lets the user listen to them a limited number of times before one can buy them and gain unlimited listens. The service encourages spreading the files both on social networking sites such as MySpace and on P2P networks because of this. The artist must pay a signup fee as well as a monthly fee, but keeps all the money generated from the online sale, as well as any associated advertising revenues, should there be any [11].

7Digital and Indiestore (www.7digital.com and www.indiestore.com)

7Digital is a quite traditional online music store featuring both major label and independent label artists, with files in protected WMA or AAC, as well as some in MP3 format. Indiestore, however, run by 7Digital, is directed at new artists, letting them upload a set number of songs (currently 4) for free, set the file format and price, and sell directly from the site. There is also a more professional solution available for a yearly fee, which enables the artist to become chart eligible in a number of countries, as well as raises the artists' share of the revenue from 70% on the free service, to 80%, amongst other advantages [12].

Jamendo (www.jamendo.com)

Jamendo lets artists upload and distribute their music files under "Some rights reserved" Creative Commons (CC) licences [13]. This CC licence lets the users play, edit and share the music with peers for free, and the service encourages users to spread the music files on P2P networks. Payment to the artists occurs only when their songs are used in a commercial setting. However, Creative Commons licences are not implemented in all countries, so misuse of the songs can occur outside the artists' control in the countries without a licensing scheme for CC. However, there is ongoing work to add functional Creative Commons licences to jurisdictions in more and more countries. To support the artists, users can write positive reviews on the site, or directly donate funds [14].

Magnatune (www.magnatune.com)

This service allows the user to listen to (stream) full albums and also, buy the

album using a dynamic pricing model, allowing the price to actually be set by the user, but with a minimum price currently set at \$5. This pricing model is obviously playing on the users' conscience, as it also works, as, according to its founder John Buckman, "the average is \$8.93" [15]. Artists that already have recorded an album, can send it to Magnatune, who will then select whether or not it is good enough for it to be put up on the site for sale. The revenue of the sales will then be split 50/50 between the service and the artist. Magnatune also uses Creative Commons licensing for their music files, and licence out music for use in commercials, television programs, compilation CDs and much more [17].

SNOCAP and MySpace (www.snocap.com and www.myspace.com)

MySpace has, in addition to being the most popular social networking sites on the Internet, long had a function of a display window for new artists, allowing them to have their own page where they could upload a limited number of songs the users could play back as many times as they wanted. However, there was not a direct sales solution available for the songs. Eventually though, in September 2006, MySpace announced that they had reached an agreement with SNOCAP to provide the back end for a sales platform on their site [18].

SNOCAP was founded in 2002 by the creators of the original Napster, including Shawn Fanning. More of a framework than a service, it lets the artist (or rights holder) to upload their songs to SNOCAP's "Digital Registry" of music, set usage rights, and embed a mini-store (called "MyStore") on any website, including MySpace, another artist web page or a weblog. From this mini-store users can buy

songs from the artist, at a price set by the artist or the rights holder. However, SNOCAP currently charges the rights holder a \$0.39 fee for each song downloaded [20].

Another very interesting feature of SNOCAP is its plan to use not only online retailers, but also “authorized peer-to-peer networks” to legally distribute music, as its Software Developer's Kit (SDK) “provides peer-to-peer application developers [with] the tools they need to access sound recording copyright information from SNOCAP's Digital Registry to legitimately offer copyrighted content for sale”, and that this content can be used in accordance with “the distribution terms set by the sound recording copyright owner” [19]. However, SNOCAP has not stated clearly what type of authorization the participating P2P networks should have, or who provides it. P2P client applications would need a plug-in to identify the songs on the network through an audio fingerprinting technique originally developed by Philips Labs [21], allowing the correct song to be found on the network, and bought and downloaded, or listened to through it, depending on the copyright information and use restrictions set by the copyright holder. However, this P2P solution have not caught on as much as SNOCAP expected, and their main business focus for the time being remains the “MyStore” mini-stores.

The most differentiating feature of SNOCAP compared to another online music sales solutions is the fact that it has no centralized website from which sales are based, instead it is based on sales from decentralized websites or P2P nodes, while only the licensing server is centralized.

Snocap and CDBaby ended an 8-month partnership in October 2007 that would have allowed CDBaby customers to make Snocap MyStores with their own music and publish them on other websites. However, CDBaby got a heavy customer support load on this issue, and was making only marginal profits on the partnership, so they decided to end it [53].

Seemingly, business is not looking too good at SNOCAP, as massive layoffs at Snocap were announced, also in October 2007. They have also actively sought a buyer for the company. About 60 percent of the staff were let go. A restructuring of the company was, according to a press statement, the reason for the layoffs [54, 55].

Grooveshark (www.grooveshark.com)

Grooveshark is a service that currently only is in beta status, but it has some interesting ideas behind it. Users log in to the service to share their private music collections across the Grooveshark P2P network, and can search for other music on the network, via the Grooveshark client application. So far the description seems very similar to illegal file sharing networks, however, these downloads are not free. The income gets distributed so that the rights holders gets their rightful share, while the rest of the income is shared between the service and the user who uploaded the file. Unfortunately, I was unable to locate information on how users' tracks are recognized on the network, whether it is with the help of some fingerprinting technique or just through ID-tags. Grooveshark doesn't have deals

with many record companies yet, only with performing rights organizations ASCAP, BMI and SESAC [56, 57]. If they manage to get more deals with record companies, as well as better and more advanced methods for filtering out illegally shared files, there is real potential in this service.

5.12 Artists employing new distribution models

Acclaimed British band Radiohead, previously signed on Parlophone/EMI, currently out of contract, released their latest album "In Rainbows" directly through their own website [69] as a download or as a package featuring CD and vinyl discs and artwork. While not particularly revolutionary in itself, however, the pricing model for the download raised a few eyebrows and got a fair amount of media attention; fans could pay whatever amount they liked for it.

Within the first week available, 1,300,000 downloads of the album have been sold, and the figures are still rising. But according to media tracking firm BigChampagne, who has tracked the album on file sharing networks, about 500,000 have downloaded it through those means. BigChampagne chief executive Eric Garland also predicts that the numbers of downloads through file sharing networks will surpass the numbers of downloads from the official site [70].

While there is nothing new in that an album is spread across file sharing networks, but the noteworthy part here is that this is an album that can be acquired legally for free. Garland argues that this is a matter of habit rather than economics, that

people are used to using a file sharing service to acquire their music, rather than (in this case) using Radiohead's website, which may be unfamiliar to them. He also claims that "it's simply easier for folks to get the illegal version than the legal version,"

However, it seems the media attention the band has gained because of this pricing model has helped increase their album sales, as their previous album "Hail to the Thief" sold only 300,000 in its first week, a considerably lower volume than "In Rainbows" [71]. It may also have been economically very lucrative for the band, as their "direct-to-consumer" approach involves no record companies, and the band retains the full revenue stream of album sales. Early reports suggest that the average price paid for the download was between \$6 and \$8, and that the band have earned between \$6 and \$10 million on initial sales [72].

Moreover, the band is now planning to also release the album on physical formats, and are currently seeking distributors outside of the major label system, even as the band's vocalist Thom Yorke has called the current way of doing business in the record industry a "dying business model" [73].

Famous artist Prince has also gone to some drastic steps with the release of his album "Planet Earth", released in the summer of 2007. Initially he gave 2,81 million copies of the album away for free with British tabloid newspaper The Mail on Sunday. Both the newspaper and the artist are reported to have profited from this cooperation. As a reaction to this, his record company Sony BMG UK became

very displeased and dissolved the one-album contract Prince had with them. The album was also physically available on CD in traditional retailers, although many criticized the give-away strategy. Prince's "efforts" with this album was viewed by many as a publicity stunt and marketing ploy for promoting his series of concerts a little while after the album's release [74].

In September 2007, Prince, in association with WebSheriff, launched lawsuits against eBay, Youtube and The Pirate Bay because of copyright infringements. Out of these, the cases against eBay and Youtube is looking likely to be settled peacefully, whereas the Sweden-based Pirate Bay falls under a different legislation and will probably not lead to anything [75, 76]. It seems that Prince wants to control every aspect of the distribution of his music and videos, and as it is a well-known fact that he is not a fan of the major record companies, he is trying to figure out ways to bypass them as best as he can.

Guy Hands of the private equity firm Terra Firma, which bought EMI in May, 2007, has called for modernization of the music industry, and suggests that unless there is a major change in the industry, other established bands [than Radiohead] will shun away from record companies, and instead sell their music directly to the consumers online [77].

More bands are speculating on whether to follow in Radiohead's footsteps and release a direct-to-consumer album from their websites. Oasis and Jamiroquai are known to be considering such options, while British band the Charlatans is already

offering their new album online [78].

These direct-to-consumer models are definitely an interesting prospect for artists with an already large following, but they can also be pitfalls for smaller artists. Such models require artists to bear all costs of recording, mixing and producing themselves, as well as marketing and promoting the finished product. Granted, marketing can be done online through various channels at lower costs than traditional marketing, but there is still a significant cost that needs to be paid even before the music is released. For bigger artists, this may not be a problem, but for smaller artists and bands it may not pay off in the end.

A number of smaller artists, such as British rockers the Arctic Monkeys and singer Lily Allen, have gained record deals and large followings through releasing some of their songs through MySpace [79] for listening (and thus 'sampling'). Until MySpace's cooperation with SNOCAP however, users were not able to buy music from the site, only listen to it through streaming.

5.13 *The issue of declining sales*

The record industry have complained about the decline of music sales ever since P2P file sharing became a household term. Worries from the industry have also surfaced every time a new technology that enabled copying has been introduced on the market, such as dual cassette decks and CD burners.

A study by Hong in 2000 [24] found that although a portion (different methods of

calculations were used, but none with more than 33%) of the decreasing record sales could be attributed to “the Internet and plausibly Napster”. There were also other factors involved, such as the pricing of entertainment goods, and a previous increase in sales in the 1990s due to a transition of formats from LP or cassette to CD.

Since the advent of the original Napster, the record industry has been claiming that illegal downloading of copyrighted music files are in fact hurting hurting the physical album sales, and has showed its decreasing revenues as proof. In 1994, professor Felix Oberholzer-Gee and co-author Koleman Strumpf released a research paper that shocked the record industry. The findings of the research were that illegal downloading did *not* hurt CD sales, and it could even increase sales within some music genres.

One of the key findings in their research was that a large group of downloaders only downloaded a couple of songs from an artist or album, presumably to just to get a “sample”, in order to make a decision on whether or not to buy a CD from that artist. They claim that P2P worked much in the same way as the radio, as a tool to promote new music. However, as the research data in this paper hails from 2002, when broadband connections were very much rarer than in the present, there is reason to believe that this pattern has changed, and that full albums, instead of such “samples”, are downloaded to a much larger degree. Still, even so, the promotional effect achieved can be just as great, though this will be difficult to measure properly. They also argued that there was another group of downloaders

outside of these 'samplers' that were either too young or with too little income that they would have bought the music they downloaded anyway [64, 65].

Still, what must also come into consideration, is that while music sales have declined, total media sales have stayed consistently high, with music facing competition from other media such as DVDs and video games.

6 Research basis

6.1 The problem at hand

I have set out to figure out how the dynamics between illegal music file sharing and legal actions and alternatives have affected the current digital music landscape, and also try to see how it will continue to do so in the future. Also, how and why has the digitalization and illegal distribution of music created such a stir and unease in the music business, and also changed much in the way music is used, as well as the value of the music for the public.

For the consumers, change has come much in the form of the ease of access to music through file sharing networks, the ability to obtain (ie. download) the only song you wanted (either legally or illegally), and not having to buy the whole album to obtain it, as well as the rapid increase of the portable music player market, such as Apple iPods. Also, it has become very common to store one's music library on a computer, whereas storage space, or the lack of good compression formats for music may have hindered this earlier.

The record industry has, with the free and open nature of the Internet and file sharing networks, lost much of their presumed control over the copyrighted works that they own the rights to. With one CD album, one can simply rip it onto a computer, and if made available on the Internet, almost a limitless number of users can obtain copies of the music files from that album. File sharing networks have

adapted to constant legal pressure and lawsuits that the industry's major companies and organizations have launched as attempts to regain some control. Legal solutions for downloading copyrighted music have been launched, and even though their sales are on the increase, the downloads from these stores are still marginal compared to the amounts of illegal downloads on file sharing networks.

Downloaders from file sharing networks can have a variety of motives for doing it, there are young people who have grown up with the original Napster, with the notion that music is, and should be free, or simply that they can't afford it, there are 'samplers' who download a song or a set of songs to sample an album or an artist, possibly with the intention of buying it later if they like it, and there are those who download because it is seen as a free alternative, see the physical albums as outdated, or because the legal alternatives simply does not offer the same quality, both with the ease and liberty of use, the selection of songs available, or audio quality. There are of course huge differences in these factors among legal and illegal services, but they are still some of the criteria used by consumers for determining whether or not it is a qualitative service.

Lawmakers have seen pressure mounting to revise and tighten copyright laws from the organizations protecting the interests of the major record companies in the recent years, particularly the RIAA in the US (where these 'majors' have their head offices) and the IFPI internationally. Many countries, at least in North America and Europe have seen such laws materialize in the last few years. Also, in many European countries, including Norway, there have been great pressure for

applying laws on the interoperability of devices, related to music formats and DRM systems. France has in fact already applied such a law.

Also, the artists behind the music have started to see the possibilities of the Internet and digital music. Some artists have complained that the record companies are taking a too large share off the income on legal digital music, now that the cost of packaging is gone, and distribution costs are extremely low, compared to physical distribution. Promotion of music can also be done radically differently on the Internet than what has previously been the case. Many (particularly smaller) artists have profiled themselves through 3rd party websites such as MySpace, or through their own website. In the last few years, a large number of websites and services have been made for unsigned or smaller artists as portals where they can promote themselves and also, sell their music files through. Some more famous artists also sell their music through their own website.

Then there are the P2P services and the people behind them, as well as academics and organizations fighting for free culture and free speech on the Internet, such as Lawrence Lessig and the Students for free culture movement [82], who are negative to current restrictive copyright and intellectual property laws, and argues that they dampen creativity [81]. But it is arguably the Electronic Frontier Foundation [36], who has been the most formidable opponent of the tightening of copyright laws.

With so many groups with differing interests in the same market, the digital music

landscape is characterized by much uncertainty and confusion on what's to come, and the present solutions seems temporary at best, in this fast moving landscape. As there is so much uncertainty on the future, and indeed a highly complicated network with a large number of different interests currently out there, my goal has been to bring a sense of overview and clarity to the situation.

Looking at the whole of the network involved, and analysing it through its parts, will be highly beneficial to finding answers and figuring out more on my approach to the problem.

7 Analysis

7.1 *Introduction to ANT as a method*

All of the legal and illegal solutions, as well as legal cases described, share an interconnectedness within a huge, complex and constantly evolving network, where changes in one part of the network will affect large parts, or the whole of the network, to varying degrees.

I have chosen to use Actor Network Theory (ANT) in order to describe what this network looks like, how the different elements are connected and how they relate and adjust to each other. ANT is not a theory as such, but an important tool for viewing, describing and analyzing the complexity, as well as relationships and associations between the actors [I believe ANT is a good tool for understanding these relationships, as it includes both technological and non-technological elements, and treats them as equals within the network, giving them the same attributes. I.e. when utilizing this method, the technologies, as well as humans, can have their own interests, needs to be recruited to the network and to be negotiated with. Thus, the neutral term *actant* has been applied to describe the doer of the acts in the network [80].

Actor Network Theory also allows for zooming in on various parts of the network, and “black boxing” areas of the network or certain groups of network elements, to study how these parts communicate between one another and to see whether or not an alignment of the (partial) network is possible, and eventually how this may

be. These features of ANT will be particularly useful for such a large and complex network as the digital music landscape comprises.

I will initially identify the actors in the network. I have grouped some actors of the same category into the same actor, eg. I have classified P2P Services as one actor, and not included ie. Kazaa or Limewire as individual actors. This is because I see that they generally have the same inscription and behavior. Same category actors that may differ in some aspects of ANT and that have been grouped as one actor, can be zoomed in on to clarify the differences.

7.2 *The actors in the network*

- P2P/Filessharing technologies
 - Protocols
 - Network types
- P2P/Filessharing services
 - Applications
 - Clients
 - Websites
- Digital music files
 - Different formats (uncompressed, compressed, open, closed)
 - Different quality compression
- DRM implementation
 - Different implementations

- Different levels of user restrictions
- Physical music formats
 - CD album
 - CD single
 - Older formats
- The recording industry
 - Record companies
 - The major labels
 - Sony BMG, Universal, Warner, EMI
 - The “independent” labels
 - Industry organizations
 - RIAA
 - IFPI
 - Numerous other national organizations
- Copyright law (and lawsuits)
 - Relevant copyright laws – restriction of usage rights
 - Lawsuits against P2P/Filesharing services
 - Lawsuits against users of P2P/Filesharing services
- Governments
 - Lobbying groups influencing the decision-making process of lawmakers
 - Pressure for more interoperability in many European countries
- Music consumers
 - Users of P2P/Filesharing services

- Buyers of digital music
- Buyers of music on physical media
- Concertgoers
- Legal solutions for digital music
 - Different types of file formats offered, with or without DRM implementations
 - Different types of models
 - The “a la carte” model
 - Subscription models
 - Variations and combinations of these
 - Other alternative models
- Artists making music
 - Sales through record company on physical discs
 - Sales through record company/third-party on digital format
 - Sales through a third-party/first-party website/application (primarily unsigned artists)
 - Direct-to-consumer digital sales/distribution
 - Artists releasing music under liberal licencing/use rights (CC) for free or for a fee
 - Artists making money through playing concerts and merchandise sales at concert venues
- Usage rights of (legally) obtained music
 - Traditional licencing regulations versus Creative Commons licencing
 - Licencing for commercial/non-commercial use

- Remixing, sampling
- Rights for sharing music
- Organizations for free speech and free culture on the Internet
 - EFF
 - Students for free culture
 - Others

Many of these subgroups of who I see as actors can also be overlapping, such as a music consumer who buys physical CD's, but also downloads from file sharing networks. However, I feel my general overview presented in figure 3 represents the network in a good way. Still, as with all socio-technical networks, there will also be outside factors, such as some influential media view or political event that may influence the look or workings of the network.

The relationships between the actors are on different levels, and can have very different intentions and meanings.

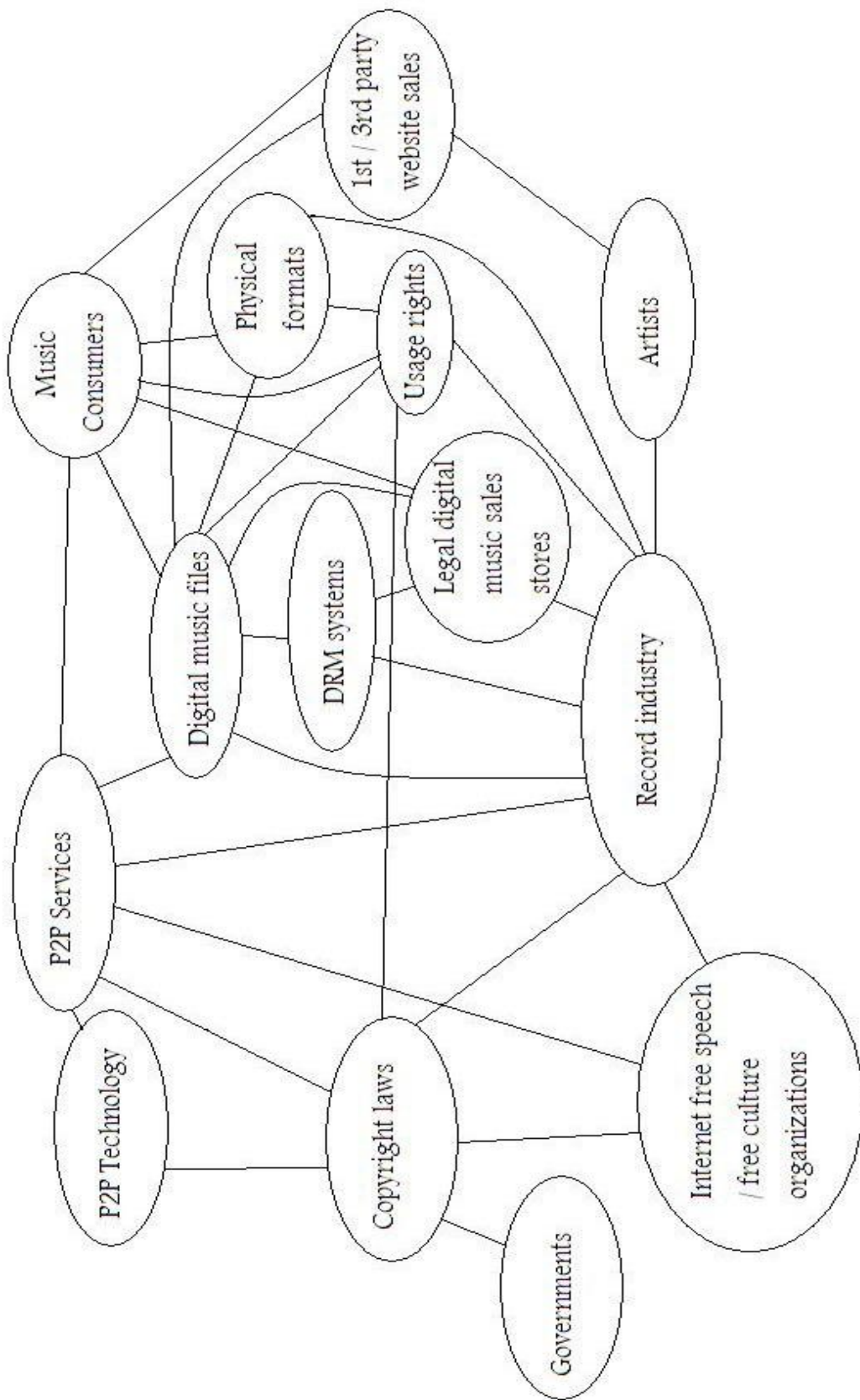


Fig. 3: Actors and relations in the network

While the record industry is multi-faceted and consists of not only the major record companies and their interest organizations, but also smaller, so-called independent (because they are not a part of the 'majors') record companies, I have chosen to group them into one actor. The inscription of the whole of the record industry seems quite unified, although there also exists opposing, and possibly quite influential factions, particularly within the independent record companies. Still, their common goals remains to make profits through releasing and promoting music by artists. Some see the music more as art than entertainment, perhaps, but they still need to make money.

The relationship of record companies and artists is one of need. If not for the artists, record companies wouldn't have a business plan at all. Artists also need the record companies to fund recording, mixing, producing, releasing and promoting of their music. However, there have been recent exceptions to this, as some established artists have found way, through the Internet, to release and promote their music without the help of the record companies. This method is of course also possible for smaller artists, but then they come at a higher risk, particularly economically. However, if the risk pays off, and the artist becomes successful, it might lead to a higher income eventually. This type of risk taking is not exclusive for digital distribution however, some artists have formed their own independent record label to release their material on. Still, on a general level, there is a relationship of need. The artist is offered a contract, where basically the record company takes ownership of the music the artist produces during their contract

period, in exchange for the recording, releasing, producing of albums, as well as offering qualified people to manage different aspects of their life as artists. Only a portion of the income the artist produces is them, as most is handled by the record company, and goes back into other sides of their operation. When artists are less known, it may be easier for them to sign contracts that they believe will propel them into stardom, perhaps without reading the fine print. Some big name artists have actually bought back the rights to their music from their record companies. However, this signing of the contract between the parts should mean that their interests are translated to become an aligned relationship, and that this relationship would become quite stable.

The main adversaries of the record companies in this network, has been the peer-to-peer services. The record industry translate the inscription of the P2P services as a threat to their income and business model, while to the downloaders from these networks it may translate as a free and easy way of obtaining new music. The different actants can translate (re-interpret or change) inscriptions based on one's own intentions and interests. Multiple lawsuits have been made towards different P2P networks. As most of them have been has been US-based, lawsuits have primarily been made from the RIAA, which also have been known to do extensive lobbying in the US senate, to ensure their interests through the lawmakers there. However, also lobbyists from e.g. EFF also are trying to influence.

The technology these P2P services are built on have had their evolution driven by

more restrictive laws. As networks have been brought down on new charges and lawsuits, new ones have adapted to the situation, and found technological solutions for avoiding or bypassing the way of functioning that had brought the previous network down. While the goals of the different P2P networks have been generally the same, the means of executing these have evolved as a direct cause of tightened copyright laws and successive lawsuits made against the companies running the services with the P2P technology. This remarkable adaptability shows that they are benefiting from an ongoing translation of the changes in the law.

The legal digital music solutions have had a slow start, but are now seeing significant rise in the numbers of users. However, the number is still fractional compared to the number of users on illegal file sharing networks. Although there seems to be a current trend of moving away from the use of DRM systems for these solutions, it is still applied on most files. When a music customer uses a digital music store to buy a music file online, the file is tied to a license which is needed to play it, but these are generally proprietary systems, making interoperability between systems and devices difficult. For full interoperability, either an open music file format, with no DRM applied, could be utilized on these stores, or the big actors on this scene, Apple and Microsoft, would have to agree on utilizing a single DRM system to be used for music. This however, would be extremely unlikely because of business purposes, and we have already seen a number of new stores using no DRM on their files (e.g. eMusic, Amazon). Many consumers have translated the inscriptions of DRM as being unnecessarily restrictive, and have questioned the need for it at all. After all, the competition (files

from P2P networks) have no such restrictions.

After the industry through RIAA sued thousands of individual users of file sharing networks, their popularity among both the general public and media, as well as in Internet free speech and free culture groups, didn't exactly sky rocket. As a business tactic to scare the public from downloading copyrighted files illegally, it can, at best, be described as failed, as downloads from P2P networks have continued to increase, and the industry's public relations have taken a sour turn. Even though the natural inscription for the record industry would be to want to get paid for the music they own the rights to, it seems that these actions have only done bad for their reputation, ie. other actants' translations of them.

The music consumers' choices of how they wish to obtain copies of, or listen to music have increased with the introduction of the Internet and digital music. They still have the choice to buy music on physical formats such as CD's (or cassette tapes and vinyl albums before that), a tried and trusted relationship that really hasn't been challenged before, by another non-physical format such as digital music is. Before, if the user wanted to buy music to listen to at home, the only choice was to buy the physical media, and there was stability in the relationship. With the digitalization of music, and ease of distribution through the Internet, all that has changed. Peer-to-peer services, legal digital music stores, as well as some 1st party artists' websites, and 3rd party websites that artists' use to sell their music through, but bypassing the record companies have eventually become available to consumers. As these new elements have been introduced into the

network, the inscription (of the music consumers) of how music was to be consumed has been significantly weakened, and the translation of the physical formats have to a large degree changed, as it no longer is the only alternative for consumers.

I also feel the consumers' usage rights should be part of the network. This is of course tied to the consumer's expectations of use, what inscriptions are translated into it by the consumer. When you buy a physical CD album, you feel that you have bought a personal copy of the music, which you can use whichever way you want within your personal sphere. But when selling you a digital music file with DRM, you are essentially just buying a license to play a copy of the music, but then letting the rights holders decide how you are allowed to use it, in which types of players you are allowed to play it etc. Many different legislations supports this, amongst others the DMCA in the USA, but the consumers will not necessarily accept that the DRM makes such a strong inscription into the music file.

Even when taking into consideration the granular nature of ANT, the fact that the most of the groups of actors are either clearly opposed to other actors, or that they lack a coherent, strong inscription, makes it harder to be able to "black box" some areas of the network (as influences or reactions from directly opposing interests that affect the actants are very common), as it also is constantly (and quickly) developing, offering little stability.

This is by no means a stable and aligned network, although in an Utopia for the

record industry; without P2P networks, it is highly doubtful that we would have seen any real attempts at all to establish a market on a territory (the Internet) that is impossible to fully control. To speculate, if such attempts at establishing legal music services were to be made in such a scenario, it would most likely be in the vein of control technologies (more so than today's DRM systems) such as in Trusted Computing schemes. Unless, of course, there would be a massive negative public response, or some legislation put restrictions on the mode of control. Even in such a case, the media interest organizations would probably put up a fight with them, and use their lobbying skills to full effect.

7.3 Complexity of the network

According to Beck and Giddens [84, 85], we live in a highly complex world where new and more complex technologies and organizational forms are constantly being developed, and this is making it more unpredictable, and thus also more unmanageable and out of control.

Complexity has been defined in a few different, but similar ways. Law and Mol's defines that a system is not really complex if it only consists of, or can be reduced to, components of one kind, such as technological. A system is only complex if it consists of components of more than one kind, such as both technological and organizational. Additionally, when problems arises, one cannot simply address the issues of only one of the types of components, both, or all of the types of components needs to be addressed, and we need to understand the way they are interacting with each other and their dependencies [86].

The digital music network is, of course, very much a part of this complex world, and according to the definition it is indeed a complex network on its own. It is a socio-technical network with both social, organizational and technological actants, or components, which interacts with each other in a variety of ways. It is also an open network that interacts with its environment, to the point where this openness makes it difficult to define its borders [87].

When the record industry is trying to make order by control, they create a disorder for the P2P services. This is similar to the theory on complexity that if we are making order in one world, we are making disorder in another, possibly unseen world [88].

7.4 *A constantly changing network*

The technological systems behind P2P file sharing has evolved in an astonishing tempo. Just ten years ago nothing like it existed. Thomas P. Hughes emphasizes the historical element of technological systems and how change happens over time. He argues that technological systems are both socially constructed and society shaping [88]. All the components of a technological system work together to form the system and share and interconnectedness where if one component changes or moves, the rest of the components must adapt or change to accommodate the new configuration that arises, similarly to the actor network.

These components can either be artifacts or system builders. The artifacts can be

either physical or non-physical, and is either invented or developed by the system builders or their associates. They are also socially constructed, and because of this it becomes impossible to limit the social context of a technological context to the environment. If seemingly outside factors are in control or affect the system, they are considered a part of the system. If this theory is applied to the P2P file sharing technologies, this would mean that just about every part of the actor network must also be a part of the technological system of the P2P technologies. The other components of a technological system are the system builders. These are not socially constructed, but are skilled in the ability to construct and create systems.

The P2P technologies has indeed also been society shaping, as music and media are a huge part of culture generally and the society as a whole, and these technologies have forced changes of strategy in both the music and movie industries, as well as for lawmakers in governments of many countries, and also for the consumers and the general public.

Hughes also argues that “large, modern technological systems seem to evolve in accordance with a loosely defined pattern” [88]. There are seven stages of growth of a system, which not necessarily are sequential, but can overlap and backtrack each other. These stages are; invention, development, innovation, transfer, growth, competition and consolidation.

Invention

Inventions can be conservative or radical. Radical inventions usually comes from outside inventors because existing systems discourage radical invention. The earliest peer-to-peer networks were definitely radical inventions. Although they built on existing networking technology, they used it in a completely new way.

Development (the transformation of the invention into an innovation)

The successful development of a radical system will culminate into technological systems. As it transforms into an innovation, it gains economic, social and political characteristics it needs for survival in the use world. The P2P networks, in their transformation, have gained such characteristics to be able to survive. As they have been brought down, new ones have come, with revised characteristics.

Innovation

Innovation is the phase where the technologically complex system is really revealed, and is viable. I see this as the phase where a technology gains a critical user mass.

Technology transfer

This phase describes the transfer of technology (system) to different environments. With Internet-based technologies, I don't really see this phase as relevant at all, because of the immediate availability and the borderless access.

Growth

When the system has been transferred (or adapted) to new environments, further growth can ensue. If the P2P technology gains a critical user mass, it can continue to grow.

Competition

Growth can be difficult because of competing rival systems that will want users/market shares. Not only rival P2P technology, but competition will come from the legal digital music stores, the record industry and governments will try to shut you down.

Consolidation

The consolidation phase is where a solution is found, where either two or more technological systems merge or where one comes out as a “winner”, and thus becomes sort of a standard. Although P2P has been discussed as a technology for legal music sales, we are unlikely to see any form of consolidation between “the file sharing community” and the record companies and their solutions in the near future.

7.5 *P2P file sharing as a potentially disruptive innovation*

File sharing services utilizing P2P technology have challenged both traditional distribution models as well as upstaged the record industry. It has to a large degree changed the way information and media is exchanged online, as well as

challenged the traditional standard client/server model architecture of networking [89]. Control of the network does not lie at a single server, but is spread out to all the peers of the network.

When the record industry first discovered that a peer-to-peer network was being used to massively spread songs that they owned the copyright to, their first reaction was: “how do we stop this?”, and not “now that we've seen this remarkable new technology, how can we take advantage of it?” So they sued Napster, and it was brought down, but we all know now that file sharing through P2P networks has only increased rapidly in numbers. Of course, it might be difficult to see a new technology and immediately recognize it as having the potential to be disruptive, but still, some warning bells must have rung when the early potential of P2P networks was materialized in services such as Napster.

A term coined by Clayton M. Christensen; “disruptive technology”, later revised to “disruptive innovation” [90, 91] describes different scenarios where a new technology or product replaces or marginalizes the currently dominant technology or product in a particular market segment. In this case, we need to consider if digital music will, or has the ability to replace or marginalize the currently dominant CDs.

There are three main scenarios of disruptive innovation; the first is a case of “low-end disruption”, and it may occur when the improvement of an existing product exceeds some customers' needs or wishes to the point that they become unable to

adopt it. If at this point a slightly inferior product, but still adequate for the certain groups of consumers, enters the market, it may gain a position in the market. If we transfer this to the digital music scenario, and see digital music files as slightly inferior versions of CD's, we have already seen that P2P downloading has a substantial user base, but also legal digital sales are slowly catching on, although slowly and marginally compared to the P2P downloads. However, although digital music has gained a certain market foothold, there is a long way to go to marginalize the CD.

The second scenario occurs when a product that is (at least initially) inferior fits an emerging or new market segment. This is called a "new market disruption". Digital music can also fit this scenario, as there have been proven there is a market for it where there previously was none, and it has definitely stolen some market shares from the CD. But for digital music to catch on more, improvements must be made in for example ease of use and audio quality, but because of the complex nature of the digital music network, these things will most likely take at least a few years.

Disruptive technology can also be superior to the existing technology. Where there is much invested in old technology, locked in existing users will want to 'milk' that technology for what its worth, because of high switching cost to the new technology. A new user will not have this switching cost to worry about. I don't see how this scenario could apply to digital music, although CDs are becoming an 'old' technology (at least 'old' in computer terms), it is flexible enough, through the process of ripping, to produce digital music itself, so the switching cost would be

marginal.

I believe there could be a possibility for a “new market disruption”, but that depends on improvements of digital music, particularly on the legal stores, as well as market response.

8 Reflections

The fact that the rights holders doesn't get paid is without a doubt the main reason behind what is causing the problem of file sharing. So, are there fair ways to stop it or limit it, or if not, compensate the rights holders?

In its current state, an alignment of the whole network of digital music seems impossible, but it is in a state of constant change, so a reasonable solution might become available in the future. Its complexity, and the pace at which it develops may also imply that the network as a whole is out of control.

Professor William Fisher has proposed a model which places a tax on ISP access, as well as government-imposed levies on technological equipment that can be used to perform music, and the revenues from this should be distributed proportionally out to copyright owners [103]. A similar taxation to this has recently been imposed in Canada. However, this model is quite radical in that compulsory levies for everyone should pay for what only some have done, at least in the USA.

The way I see it, the record industry has had a three-way plan to protect their interests and;

1. Suing P2P services, illegal downloaders
2. Information – many people don't know it's illegal
3. Coming up with better alternative digital distribution strategies

It seems pretty obvious that the plan to sue individual customers have failed. The main reasoning behind these lawsuits is to scare others from downloading, and according to BigChampagne, the average number of simultaneous users on file sharing networks has increased from 4,3 million in September, 2003, to 9,3 million in the fall of 2007. To me, it initially makes much more sense to go after the P2P service providers, but that doesn't seem to help decrease the downloading either, as new services appear when old ones go down.

Record company executives and lawyers have used the argumentation that many people doesn't know that it's illegal to download copyrighted files from P2P networks. However, I am confident that most people are fully aware of this, but many do it anyway.

The third point is coming up with better digital music sales services, and this is the point where I really feel record companies both have the most work to do, and the most to gain. I believe it would be beneficial for the record companies, at least in the long run, to listen more to what the consumers want, and actually compete with the file sharing networks, instead of just combating them. That way they can regain some of their lost public trust and goodwill, and strive to offer more competitive alternatives.

9 Work method

When working with this thesis, I wanted to obtain an overview of the digital music landscape. It is an extremely fast moving world, and there have been constantly new news items and cases presented in the media.

As this situation requires you to follow cases in the media, I have spent a lot of time searching the web for pages with both relevant news items and background information. Also, when providing a background in this thesis, I also found a lot of material on the web, as well as in literature.

I wanted to provide an overview of the situation in the digital music landscape, and I found no other articles that did this comprehensively. Many books and articles covers different parts of the landscape, but not a complete overview.

For my analysis part, there were a few books I had great use of, particularly the literature on Actor Network Theory and complexity.

10 Conclusions

With good enough solutions I believe that we will see consumer attitude changes, and in the long run illegal file sharing *can* get marginalized, but it will never be completely crushed. This will also require a that good enough legal distribution and sales solutions are realized. I believe that compensation models will just fully legalize the illegal downloading, and that those who download music should pay for it and those who don't shouldn't. If we continue to see a an increase of quality of current legal music services, then legal digital music can eventually marginalize the CD, and marginalize illegal downloading. By offering the legal downloaders e.g. the same freedom and ease of use, and better audio quality, ie. a better offer than what the P2P sites have, there is a chance for this. But there is still a long way to go.

People will always continue to swap music and other media through unofficial channels. But if the record industry manages to turn the free downloading of copyrighted material away from being an activity for the masses and into being an activity for a minority of "techies", then I believe they will think they have won. However, as the illegal downloads are only increasing, other strategies may need to be applied. If a legal download store can offer a better service than what the P2P services can, I believe we will see a lot of new consumers in the legal music store market, and that these consumers are willing to pay for their music so long as they get a quality package when they go shopping.

Many consumers have become too accustomed to the idea that they shouldn't pay for music. Either way the distribution models for digital music will look in the future, the artists also need an income, whether they are promoting themselves or on a record label, or have their main income source from album sales, concert ticket sales or merchandise sales.

11 Literature list and references

11.1 Books and articles

- [23] Samuelson, Pamela (2003), "DRM {and, or, vs.} the law", Volume 46, Issue 4, Communications of the ACM; Special issue: Digital rights management and fair use by design, p. 41 – 45.
- [24] Hong, Seung-Hyun (2004), "The Effect of Napster on Recorded Music Sales: Evidence from the Consumer Expenditure Survey", Stanford University
- [29] Lange, Maggie A. (2001), Digital Music Distribution Technologies Challenge Copyright Law: A Review of RIAA v. MP3.com and RIA v. Napster, 45 B.B.J. 14, 30
- [30] Mulligan, Deirdre K. et al. (2003), "How DRM-based content delivery systems disrupt expectations of 'personal use'", ACM Workshop On Digital Rights Management, Proceedings of the 3rd ACM workshop on Digital rights management, p. 77-89
- [37] Sony Corp. of America vs. Universal City Studios, Inc. 464 U.S. 417 (1984)
- [38] Goldsmith, Jack & Tim Wu (2006), "Who Controls the Internet? - Illusions of a Borderless World", Oxford University Press, chapter 7 p.105-125

- [40] Friedman, David (1998), "In Defense of Private Orderings: Comments on Julie Cohen's 'Copyrights and the Jurisprudence of Self-Help'", Berkeley Technology Law Journal, vol. 13, 1998, p. 1151
- [45] Marksten, Ole Magnus (2005), "P2P-fildeling: En oversikt over nettverk og programvare for fildeling på Internett", for "Internett i endring III: Nye forståelsesformer for distribusjon og bruk av musikk i lys av peer-to-peer (P2P) teknologi", p. 5-7
- [46] Einhorn, Michael A. (2004), "Media, Technology, and Copyright: Integrating Law and Economics", Edward Elgar Publishing, chapter 4, p. 79-99
- [64] Oberholzer, F. and K. Strumpf (2004), "The Effect of File Sharing on Record Sales – An Empirical Analysis", Harvard Business School, University Press
- [80] Monteiro, Eric (2000), "Actor-Network Theory and Information Infrastructure", chapter 5 in Ciborra et. al., "From Control to Drift: The Dynamics of Corporate Information Infrastructures", Oxford University Press
- [81] Lessig, Lawrence (2004), "Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity", The Penguin Press, also available at <http://www.free-culture.cc/freecontent/>

- [83] Hanseth O., E. Monteiro, M. Grisot, M. Aanestad (2006), "Reflexive Standardization: Side Effects and Complexity in Standard Making", MIS Quarterly (Special Issue on Standard Making)
- [84] Beck, Ulrich (1992), "Risk Society: Towards a New Modernity", Sage Publications, referenced through Hanseth, O. and C. Ciborra (2007), "Risk, complexity and ICT", Edward Elgar Publishing Ltd.
- [85] Beck, U., A. Giddens and S. Lash (1994), "Reflexive modernization: politics, tradition and aesthetics in the modern social order", Polity Press, Cambridge, referenced through Hanseth, O. and C. Ciborra (2007), "Risk, complexity and ICT", Edward Elgar Publishing Ltd.
- [86] Law, J. and A. Mol (2002), "Complexities: Social Studies of Knowledge Practices", Complexity within ANT, Duke University Press.
- [87] Cilliers, P (1998), "Complexity and Postmodernism: Understanding Complex Systems", Routledge Publishing
- [88] Hughes, Thomas P. (1983), "The Evolution of Large Technological Systems", from "The Social Construction of Technological Systems", p. 49, 56-82
- [89] Oram, A., A. Oram (2001), "Peer-to-Peer: Harnessing the Power of Disruptive Technologies", O'Reilly & Associates, Inc.

- [90] Bower, Joseph L. & Clayton M. Christensen (1995), "Disruptive Technologies: Catching the Wave", Harvard Business Review, January-February 1995.
- [91] Christensen, Clayton M. (2003), "The Innovator's Solution", Harvard Business School Press
- [99] Dufft, N. et al. (2005), "Digital Music Usage and DRM – Results from an European Consumer Survey", Berlecon Research, available at http://www.indicare.org/tiki-download_file.php?fileId=109
- [102] Biddle, P., Paul England, Marcus Peinado and Bryan Willman (2002), "The Darknet and the Future of Content Distribution", Microsoft Corporation
- [103] Fisher, William (2004), "Promises to Keep: Technology, Law, and the Future of Entertainment", chapter 6: "An Alternative Compensation System", Stanford University Press

11.2 Websites and pages

- [1] <http://www.answers.com/drm?cat=technology&ff=1>
- [2] <http://en.wikipedia.org/wiki/Zune>
- [3] <http://music.msn.com/>

- [4] http://en.wikipedia.org/wiki/Analog_hole
- [5] <http://www.rhapsody.com/>
- [6] <http://www.digitalmusicnews.com/stories/111705sony/?searchterm=xcp>
- [7] <http://www.publicknowledge.org/issues/hr4569>
- [8] <http://www.freedom-to-tinker.com/?p=958>
- [9] <http://amiestreet.com/page/what-is-amie-street>
- [10] <http://cdbaby.com/about>
- [11] <http://www.elistingpost.com/info/aboutelp.php>
- [12] <http://www.indiestore.com/portal/servicelevel.aspx>
- [13] <http://www.creativecommons.org/>
- [14] <http://www.jamendo.com/en/static/concept/>
- [15] http://www.magnatune.com/info/press/coverage/usa_today
- [16] <http://www.wired.com/wired/archive/11.10/filesshare.html>
- [17] <http://www.magnatune.com/info/license>
- [18] <http://www.techcrunch.com/2006/09/02/myspace-gets-into-music-biz/>
- [19] <http://www.snocap.com/services/retailers/sdk.php>
- [20] http://en.wikipedia.org/wiki/Acoustic_fingerprint
- [21] <http://www.drmwatch.com/drmtech/article.php/3446011>
- [22] http://www.wipo.int/treaties/en/convention/trtdocs_wo029.html, referenced by
http://en.wikipedia.org/wiki/World_Intellectual_Property_Organization
- [25] <http://www.techcrunch.com/tag/snocap/>
- [26] http://www.theregister.co.uk/2006/09/13/edonkey_settles_copyright_suit/
- [27] <http://arstechnica.com/news.ars/post/20061228-8515.html>
- [28] <http://en.wikipedia.org/wiki/Edonkey2000>

- [31] <http://en.wikipedia.org/wiki/MP3>
- [32] <http://computer.howstuffworks.com/napster2.htm>
- [33] <http://www.darkridge.com/~jpr5/doc/gnutella.html>
- [34] <http://www.howstuffworks.com/file-sharing3.htm>
- [35] <http://www.kazaa.com>
- [36] <http://www.eff.org>
- [39] <http://en.wikipedia.org/wiki/Kazaa>
- [41] http://www.theregister.co.uk/2007/07/19/courts_protect_filesharers/
- [42] <http://www.ballade.no/nmi.nsf/doc/art2007071810271461054245>
- [43] http://www.ifpi.org/content/section_views/view014.html
- [44] http://www.theregister.co.uk/2006/09/13/edonkey_settles_copyright_suit/
- [47] <http://www.slyck.com/bt.php>
- [48] <http://www.bricklin.com/f2f.htm>
- [49] http://en.wikipedia.org/wiki/Home_Taping_Is_Killing_Music
- [50] <http://news.bbc.co.uk/1/hi/england/tees/7057812.stm>
- [51] <http://torrentfreak.com/oinkcd-servers-raided-admin-arrested/>
- [52] <http://www.bigchampagne.com/>
- [53] <http://www.digitalmusicnews.com/stories/102207cdbaby>
- [54] <http://www.digitalmusicnews.com/stories/101407snocap>
- [55] <http://www.digitalmusicnews.com/stories/101107snocap>
- [56] <http://www.downloadsquad.com/2007/09/26/making-p2p-pay-grooveshark-review/>
- [57] <http://www.dinside.no/php/art.php?id=492839>
- [58] <http://www.mediadefender.com>
- [59] <http://www.usatoday.com/tech/news/computersecurity/hacking/2007-09-18->

mediadefender-leak_N.htm?csp=34

- [60] <http://arstechnica.com/news.ars/post/20070916-leaked-media-defender-e-mails-reveal-secret-government-project.html>
- [61] <http://torrentfreak.com/mediadefender-emails-leaked-070915/>
- [62] <http://www.itavisen.no/php/art.php?id=397884>
- [63] <http://thepiratebay.org/blog>
- [65] <http://hbswk.hbs.edu/item/4206.html>
- [66] <http://www.drmwatch.com/legal/article.php/3657261>
- [67] <http://www.drmwatch.com/ocr/article.php/3680816>
- [68] http://w2.eff.org/IP/eff_fair_use_faq.php
- [69] <http://www.inrainbows.com/>
- [70] <http://www.digitalmusicnews.com/stories/101807radiohead>
- [71] http://www.forbes.com/technology/ebusiness/2007/10/16/radiohead-download-piracy-tech-internet-cx_ag_1016techradiohead.html
- [72] <http://blog.wired.com/music/2007/10/estimates-radio.html>
- [73] <http://www.digitalmusicnews.com/stories/102307radio/view>
- [74] <http://www.digitalmusicnews.com/stories/071807prince>
- [75] <http://www.digitalmusicnews.com/stories/100407artists/>
- [76] <http://www.digitalmusicnews.com/stories/091307prince/>
- [77] <http://www.telegraph.co.uk/money/main.jhtml;jsessionid=TIMUMYTB0RK5QFIQMGSFFWAVCBQWIV0?xml=/money/2007/10/08/cnemi108.xml>
- [78] <http://www.digitalmusicnews.com/stories/101007diy>
- [79] <http://profile.myspace.com/index.cfm?fuseaction=music>

- [82] <http://freeculture.org/>
- [92] <http://w2.eff.org/IP/P2P/riaa-v-thepeople.php>
- [93] <http://www.slyck.com/news.php?story=1465>
- [94] <http://thepiratebay.org/>
- [95] <http://arstechnica.com/news.ars/post/20061206-8368.html>
- [96] <http://www.apple.com/hotnews/thoughtsonmusic/>
- [97] <http://www.drmwatch.com/ocr/article.php/3693316>
- [98] <http://www.drmwatch.com/ocr/article.php/3669946>
- [100] <http://www.openp2p.com/pub/a/p2p/2000/11/24/shirky1-whatisp2p.html>
- [101] <http://en.wikipedia.org/wiki/Darknet>

All links were rechecked and validated in October 2007.