Spoofing, Sniffing and Suing – Major Record Companies' Response to File Sharing

Anders Edström FREJMAN

Royal Institute of Technology (KTH), Media Technology and Graphic Arts,
100 44 Stockholm, Sweden
Tel: +46 70 5 89 83 80, Fax: +46 8 534 60 690, Email: frejman@kth.se

Abstract: File swapping on P2P-networks has literally turned the music business upside-down. Declining CD-sales and the fact that on-line music distribution might be a major channel in the future has forced record companies to reluctantly embrace on-line sales. This paper tries to describe present methods used by the content industry to fight on-line piracy. What are the strategies behind flooding the networks with junk files? Are they acceptable, wise, unavoidable or simply irrelevant? What counter productive effects might follow? The study concludes that the present business models need to be refined in order to attract the present users of free P2P-networks back to a "legal" industry.

1. Introduction

The major record companies' response to the ever-growing popularity of file sharing networks has been a mixture of confusion and fear. The origin is the fear of the potential for making any number of perfect copies when digitized versions of works can be swapped in electronic networks. The initial response has been to hinder the availability of digital versions, or make them available only under strictly controlled conditions.

The early "legal" downloading sites, such as PressPlay and MusicNet, which the industry gradually made available after the close of the Napster peer-to-peer network, did not attract considerable consumer interest and were closed not long after starting operating. The first commercial successful legal downloading site was Apple Computers' iTunes, somewhat ironically in this context, a company not known as a content provider.

The fight to hinder illegal file sharing of copyrighted materials has involved:

- Legal measures against companies offering file-sharing applications or access to copyrighted materials (MP3.com, Napster, Grokster, Sharman networks/Kazaa).
- Attempts in the courts to get P2P technology outlawed, by maintaining that it encourages citizens to break the law.
- Suing individual users.
- Lobbying politicians and encouraging speedy and strict enforcement of the terms of various international conventions and directives (WIPO copyright convention 1996, EU Copyright directive 2001)
- Filling P2P networks with spoof files and decoys (a service provided by companies such as OverPeer in the USA)

At the same time, however, the same major record companies are basing more and more of their marketing strategies on information about consumer activities in these same P2P networks. Such data is gathered by the processes of "sniffing", i.e. eavesdropping on request traffic in file-sharing networks. Big Champagne in USA is one of the major aggregators and suppliers of this information. Similar strategies are already being applied by the film industry in its attempts to thwart the up- and downloading of files via P2P networks.

Notably the rollout of broadband services is seen as a major means for achieving many Information Society goals in Europe. P2P traffic is a main driver of broadband usage.

2. Objectives and Main Methods

The objectives of the paper are to evaluate entertainment industry strategies in the context of the shift to an information- and knowledge-based society. Are they acceptable, wise, unavoidable or simply irrelevant? What further research is required, and what are the likely impacts for policy-makers?

The main means of collecting data for this paper have included following legal actions against technology firms. P2P application providers and individuals have been followed closely via studies of trade papers.

Spoofing has been empirically studied in networks affected by polluted files – this has specifically focused on audio files. A sample of old and new songs reflecting mainstream and more obscure tastes has been the basis of searches in different P2P networks. A large number of files have been downloaded making it possible to estimate the equivalent data volume of correct files and spoofs.

By combining this data with information from articles and P2P-forums, in this fast moving arena, it has been possible to identify a number of important issues arising from the sabotage strategy being applied by major content owners.

3. Main Defensive Strategies

3.1 Outlaw P2P-Technology and Lawsuits against Manufacturers of File-Sharing Software

Napster was an easy target for the music industry due to the use of a central server in order to keep track of the shared files on the network. Napster could easily be accused of being responsible for the exchange of copyrighted files over the network. The network died in the same second as the company was obligated to shut down its central server [1].

As a direct result the structure of the succeeding networks e.g. FastTrack (KaZaA, Imesh) and Gnutella (Limewire, Brearshare) was highly decentralised. The protocols also allowed users with high bandwidth to operate as "super nodes", i.e. a semi-centralised network, yet very redundant. Thousands of users started sharing a multitude of files each and the popularity of file sharing grew exponentially the following years. By April 2003 FastTrack had over 4,4 million active users[2] and by May 2003 over 330 million copies of KaZaA were reported downloaded[3]. Thereby KaZaA became the most downloaded application software ever.

To stop P2P-networks, the RIAA and MPAA tried to outlaw P2P-technology through several lawsuits against the companies that provide and support file-sharing software. However the content industry has experienced several setbacks during the first five years of legal actions.

In April 2003 federal court Judge Stephen Wilson, Los Angeles, ruled that Streamcast (Morpheus) and Grokster could not be held guilty for copyright infringements by individuals using their software [4]. The judge compared these companies to manufacturers of copying machines or video recorders, both of which can be used to infringe copyrights. No one sues these manufacturers for the deeds of their users. This decision was partly overruled by the US Supreme Court in June 2005, with the marketing of such services being declared illegal.

Previously in December 2003, The Dutch[5] Supreme Court had concluded that KaZaA peer-to-peer technology and distribution of the program was legal and in August 2004 the 9th U.S. Circuit Court of Appeals In Los Angeles also ruled in favour for companies providing P2P-software[6]. The court concluded that a re-examination of the law according to RIAAs/MPAAs wishes might satisfy their economic goals but affect general copyright law in profound ways that would be difficult to predict.

The U.S. Supreme Court's unexpected decision from June 27th 2005 – partly reversing the decisions of lower courts – raises important questions. Will it stifle innovation by creating fear amongst P2P developers? Some observers fear that the Supreme Courts decision will lead to arbitrary decisions concerning definitions of "inducement", "unlawful intent" and products intended to "encourage users to engage in infringing activities".

3.2 Suing Individual Users and Lobbying for Stricter Copyright-Laws

The prime strategy of the international trade organisation for the record companies, the IFPI, has been – especially during the last two years – to display messages on file sharers computers, flood the media with press releases, interviews and articles on the claimed impact of file sharing and CD-piracy. Suing individual users has been the most effective way to attract media interest and thereby spread out the message: It is illegal to share your music files on the Internet and you might end up in court.

By April 2005, over 11,500 lawsuits had been filed against illegal file sharers worldwide, according to IFPI[7]. During the first year of legal actions in Europe, 248 individuals, mostly men aged 25-35, have paid average fines of €3,000 or faced other types of sanctions.

The main targets have been major file swappers sharing thousands of files or more using Fast Track (e.g. KaZaA, iMesh), but the latest[8] wave of lawsuits coordinated by international IFPI also comprises other big P2P-networks such as Gnutella (e.g. LimeWire, Bearshare, Shareaza) and DirectConnect. According to Geoff Taylor, General Counsel of U.K. based BPI, there won't be anywhere to hide of you are sharing files illegally.

But the networks tend to become more closed which also affects the work methods representatives for e.g. RIAA and MPAA are forced to use. According to Henrik Pontén, legal expert at Antipiratbyrån, a Swedish organization against on-line piracy, the only way to blow big (DirectConnect) networks is to play-along[9]. Antipiratbyrån uses infiltrators (physical persons), a method that has been heavily questioned and has attained mixed results so far. More importantly, Antipiratbyrån remotely gathers information about IP-adresses, alias, server names and time of crime, information that has been forwarded to the Swedish police and Internet Service Providers concerned. The latter method has been considered as a direct infringement of the Personal Data Act by the Swedish Data Inspection Board [10], [11].

A parallel strategy is lobbying politicians and encouraging speedy and strict enforcement of the terms of various international conventions and directives (WIPO copyright convention 1996, EU Copyright directive 2001). This has been a long term strategy for the RIAA and MPAA and today 30 countries have signed the two WIPO treaties, the Copyright treaty and the Performances and Phonograms Treaty (WPPT)[12].

3.3 Spoof Files, Decoys, Anti-mp3-worms and Contaminating Downloading Streams

Overpeer is perhaps the most well known company that works with the content industry by flooding P2P-networks with false or invalid files. Even though Overpeer declines to reveal its customers, they probably have all major movie and music companies as clients. It is likely that the content owners involved desire to stay anonymous, on order not to offend potential customers swapping files on the Internet.

To Wired news[13] Overpeers' CEO, Marc Morganstern, revealed that the company is using an "extensive network of servers" and that "there are several different techniques we use to intervene and make it very difficult to find and download pirated material. It involves software and hardware and proprietary information." Furthermore, in order to make a spoof file omnipresent on a P2P-network it need to be distributed in at least 10,000 copies. Since a P2P-network consists of hundreds of thousands of computers in numerous clusters a professional spoofer needs enough servers to stay in contact with each cluster.

A more sophisticated[14] way of fighting music downloads has been developed by the Finnish company Viralg that predicts the end of unauthorised file sharing. The company claims to have the techniques to corrupt a file in-between the source and the receiver of a file during download. Viralg claim that their application is able to create a viable non-working file with a working hash using their patented "overwrite" technology. The Finnish branch of BMG is praising the technology claiming that it has helped to increase its market share from 15 to 25%. A conclusion that is highly unlikely in a wider context.

A totally different tactic in the war against illegal file sharing seem to be the so-called Nopir-B worm[15] that spreads through P2P-networks disguised as a program to make copies of commercial DVDs. According to the French Internet security company Sophos[16] the worm displays an anti-piracy image on the screen when run. The worm will then delete all COM and MP3 files from the computer and try to change some vital settings on the computer running Windows. Nopir-B is not the first known so-called malware that attacks mp3-files. The Klez-F worm from 2002, the Scrambler worm and the Mylife-G worm also attacked mp3-files in various ways, but the way of distribution is what distinguishes this worm from the others.

Apart from widespread flooding of spoof-files in P2P networks, there is no evidence that the spreading of this worm is sanctioned by the music industry, but it is interesting that only mp3-files are affected and not AAC- or WMA-files (both supporting DRM).

3.4   Publishing Surveys, Quoting/Commenting Surveys and Protests from Musicians

According to official IFPI-statistics CD sales have declined after the peak in year 2000. Independently of file-swapping, a number of factors have probably contributed to this development, e.g. declining musical diversity in radio, legal downloading services, competition from services such as webradio, mobile ringtunes, cable/satellite-tv and gadgets like videogames, PDAs, cell-phones, mp3-players. On top of this customers might have completed replacing their favourite LPs with digitally re-mastered versions, the most likely driver of strong CD-sales during the last five to ten years.

It is difficult to prove a causality relationship between declining CD-sales and file-swapping [17]. Results from several surveys of varying scientific value – both independent and industry related – indicate that some file-swappers use P2P services as a complement to CD purchases and some use it as their main source of getting music instead of legal alternatives.

The music industry has been quick to comment [18] on surveys [19] not corresponding to this more or less accepted picture. Furthermore performing artists seem to be divided into two camps; pro P2P – or at least not completely against, and those in open opposition, e.g. Metallica & Madonna. Average citizens seem to have problems relating to multimillionaire musicians writing appeals against file-swappers stealing their music on P2P-networks.

3.5   Adding DRM to CDs and Downloadable Digital Music Files

In 2003 Apple succeeded to convince the record companies to trust the embedded digital rights management system (DRM) used in iTunes Music Store. Today the AAC-file format used by Apple and Microsoft's WMA-file format dominate the market for legal music downloads. A common denominator is the possibility to significantly limit the use of music files. E.g. the number of unique units (PC, iPod, WMA-player) a particular file can be played on or the number of times a file can be burned to CD.

A parallel strategy has been to add physical protection to music-CDs in order to limit illegal copying. This strategy has been highly criticized, not at least because users have experienced problems when trying to play CDs in e.g. cars or in PCs. In fact in some markets copying is still allowed for private use. Therefore some record companies have been legally forced to remove copy protection on CDs. Others have done this voluntarily.

4. Developments Outside the Music Industry

4.1   Technology to Fight Spoofs and Avoid Being Caught

As RIAA and MPAA strive to force Internet service providers to reveal the customers behind the IP-addresses illegally sharing copyrighted material, new techniques are continuously being developed to avoid both being caught and downloading spoof files.

   PeerGuardian, by Methlabs, is a tiny firewall that blocks connections to "black listed"[20] IP-addresses used for investigations, authorities and known sources of spoof files. The database of the firewall client is automatically updated like antivirus programs.

   Newer P2P-clients, e.g. Blubster, use encryption in order to make it harder to reveal identities. The Japanese file-swapping client WinNY hides the users IP-address and the more CPU-intensive application Freenet represents an even higher level of anonymity.

   Credence[21] is an application that runs on top of the Gnutella client LimeWire. It relies on honest peers judging the authenticity of online content and is the first peer-to-peer reputation scheme according to its originators. It helps P2P-users to avoid downloading spoof files with the help of other peers' aggregated experience and votes.

4.2   Number of File-Sharers Continues to Grow

Despite regular reports on decreasing usage of P2P networks following legal actions against individuals, millions of users are connected to such services. The number of file-swappers have more than doubled from August 2002 to August 2004 and the population of file-swappers is growing, according to data from BigChampagne[22]. Aggregated statistics from the P2P information site slyck.com indicate the same tendency. The biggest five P2P networks had over nine million active users[23] by late June 2005.

   P2P networks still seem to be used mostly for music files but the interest for audiovisual content tends to grow with the rollout of broadband services. The film industry's anti pirate office in Sweden reports that there are over 450,000 regular downloaders of films supplied by 250,000 regular up-loaders – in a country with only nine million inhabitants but high internet take-up.

5. Empirical Spoof File Study

The aim of the survey was to understand if the war against illegal downloading is concentrated to certain genres, only recent popular releases of music or whether even older recordings are affected. To understand how P2P-networks are flooded with audio spoof files, over 600 mp3s and windows media files were downloaded during February and March 2005, representing both new and older music, mainstream and narrow genres.

   A complete copy of the gramophone archive of the Swedish Public Service Radio, Sveriges Radio, was used to pick out the earliest documented release date of each and one of the selected works. Apples online service iTunes was used to get a modern genre classification.

   Three major P2P-networks were investigated; FastTrack, Gnutella and eDoneky/Overnet using KaZaA Media Desktop v 3.0, LimeWire 4.8.1 and eDonkey2000 v.1.1 respectively. Sharing was disabled using each and one of the clients.

   The three clients were run one at a time on the same Windows XP machine due to the massive CPU and network usage. All tests were performed on an ordinary PC running Windows XP Professional using a 5 Mbit ADSL Internet connection (Swedish ISP).

   It was desirable to download as many music files (by original artists) as possible according to the search criteria. However the results were limited by three reasons:

   (1) The search engines on each client proved to be a little bit too "forgiving". For example "ABBA" combined with "Mamma Mia" resulted in hits on totally different works by the same

artists and – as expected – numerous covers. Therefore the number of hits in table 1 might be a little bit high for some artists.

(2) The high number of unsuccessful downloads resulting in messages like "more sources needed" or "download failed". A likely explanation to a lot of these problems, except from communication problems in a redundant yet anarchistic network, is the presence of "decoys", i.e. redirects that sends the download request somewhere else. No effort was made in this survey to find out the reasons for failed downloads.

(3) An inhibiting disadvantage using KaZaA was the absence of a function for automatic renaming of files. This limited the possibilities to mass-download files with the same filename.

Nevertheless 643 audio files were downloaded primarily focusing on FastTrack, the network that has been most affected by false files. In this survey a file was categorized as a spoof file if the file was silent, contained noise or in other ways had a different content than expected. Some reasonable exceptions were made, for example covers that had been downloaded were excluded in the table.

Release	Genre	Title	Artist	Search string	KaZaA Tot. #hits	#Tot downl.	#OK	#spoof	%spoof (#)
1999	Pop	Sometimes	Britney Spears	"Sometimes" "Spears"	226	14	0	14	100%
2005	Hip Hop/Rap	Like toy soliders	Eminem	"Like toy soliders" "Eminem"	145	18	0	18	100%
2000	Pop	(Love) Supreme	Robbie Williams	Supreme	241	24	0	24	100%
2004	Rock	Vertigo	U2	"Vertigo" "U2"	221	28	2	26	93%
2004	Pop	Toxic	Britney Spears	"Toxic" "Spears"	173	26	8	18	69%
1972	Rock	Smoke on the water	Deep Purple	"Smoke on the water" "Deep"	68	11	6	5	45%
1976	Pop	Dancing Queen	ABBA	"Dancing Queen" "ABBA"	60	5	3	2	40%
1975	Pop	Mamma Mia	ABBA	"Mamma Mia" "ABBA"	43	20	12	8	40%
1965	Rock	(Can´t get no) satisfaction	Rolling Stones	"Rolling Stones" "Satisfaction"	44	11	7	4	36%
1970	Pop	Leti it be	Beatles	"Let it be" "Beatles"	18	7	5	2	29%
1975	Rock	Born to run	Bruce Springsteen	"Born to run" "Bruce"	62	14	10	4	29%
1983	Rock	Bloody Sunday	U2	"Bloody Sunday" "U2"	49	4	3	1	25%
1968	Jazz	What a wonderful world	Louis Armstrong	"What a wonderful world"	106	5	4	1	20%
2002	HipHop/Rap	8 Mile	Eminem	"8 Mile" "Eminem"	26	6	5	1	17%
1971	Pop	Imagine	John Lennon	"Lennon" "Imagine"	144	19	17	2	11%
1984	Rock	Born in the USA	Bruce Springsteen	"Born in the" "Bruce"	81	10	9	1	10%
2002	Vocal	A new day has come	Celine Dion	"New day" "Dion"	33	14	13	1	7%
2002	HipHop/Rap	Hot in herre	Nelly	"Hot in herre" "Nelly"	136	6	6	0	0%
1991	Rock	The show must go on	Queen	"Show must" "Queen"	10	5	5	0	0%
1984	Classic	Spring	Vivaldi	"Spring" "Vivaldi"	9	5	5	0	0%
					1895	252	120	132	52%

Table 1: Downloads from FastTrack using KaZaA Media desktop v.3.0.

Even though this survey must be seen as a spot check in an ocean of available music files, the results are interesting. Recently released music by well known artists seem to be the main target for spoofing on FastTrack, but also somewhat older music by bands like Deep Purple, Rolling Stones, Bruce Springsteen, U2 and even ABBA is affected (see Table 1).

The Gnutella and eDonkey networks seem to be "cleaner" in terms of spoof files even though the number of junk files tends to increase according to users opinions at P2P-forums (see table 2). The big number of identical spoof files seems to be typical for P2P-networks. It its likely that false files are speedily distributed by members of P2P-communities without their knowledge. Users queue up hundreds downloads each that is performed unattended. The industry strategy seems to have been to first contaminate (and take legal actions against users on) the biggest network and then move on to other networks. Probably due to the need for numerous servers containing spoof files attached to various clusters on a P2P-network.

Genre	Title	Artist	LimeWire/Gnutella					eDonkey/OverNet				
			Total #hits	#Total do	#OK	#spoof	%spoof	Total #hit	#Total do	#OK	#spoof	%spoof
Rock	(Can't get no) satisfaction	Rolling Stones	333	9	9	0	0%	181/10252	4	3	1	25%
Rock	Vertigo	U2	203	6	1	5	83%	164/2195	37	30	7	19%
Pop	Imagine	John Lennon	496	14	13	1	7%	168/4026	20	17	3	15%
Rock	Born in the USA	Bruce Springsteen	403	10	10	0	0%	122/6452	8	7	1	13%
Pop	Dancing Queen	ABBA	404	6	6	0	0%	168/6217	17	15	2	12%
HipHop/Rap	Hot in herre	Nelly	423	14	12	2	14%	154/12539	30	29	1	3%
Pop	Toxic	Britney Spears	453	18	16	2	11%	174/13502	48	47	1	2%
Pop	Sometimes	Britney Spears	340	17	15	2	12%	108/13399	14	14	0	0%
Pop	(Love) Supreme	Robbie Williams	223	15	15	0	0%	171/18203	6	6	0	0%
Pop	Mamma Mia	ABBA	475	6	6	0	0%	193/8009	4	4	0	0%
Rock	Bloody Sunday	U2						169/534	21	21	0	0%
Hip Hop/Rap	Like toy soliders	Eminem		10	10	0	0%					
Rock	Smoke on the water	Deep Purple	478	9	9	0	0%					
Rock	Born to run	Bruce Springsteen	349	10	10	0	0%					
Jazz	What a wonderful world	Louis Armstrong	493	16	0	0	0%					
Vocal	A new day has come	Celine Dion	328	11	10	1	9%					
Classic	Spring	Vivaldi	342	11	11	0	0%					
				182	153	13	7%		209	193	16	8%

Table 2: Downloads from Gnutella (using Limewire) and eDonkey/Overnet.

6. Conclusions

The music and motion picture industries efforts to outlaw P2P-technology as well as suing companies developing P2P-clients seems to be driven by a strategy to discourage new players in the arena rather than winning legal battles. The industry appears to have an inexhaustible budget for top-attorneys even though the outcome of many of the legal battles have not turned out to be very successful.

Suing individual users has been an effective tactic for achieving media coverage, thereby indirectly "educating" individuals on the problems related to copyright issues and digital distribution of media content. According to recent statistics published on IFPIs website, one third of music CDs sold worldwide are counterfeits and piracy exceeds legal sales in 34 countries. This (physical) piracy is probably far more financially harmful than numerous file-swappers downloading music they already have on CD or might buy later, or otherwise would never buy. The content industry seems to prioritise suing individuals.

The strategy of suing 12 year old children for downloading the theme of their favourite TV-program or threatening single parents with jail to expiate the copyright infringements done by their underage children does not serve to strengthen the reputation of the content industry.

A P2P-network such as KaZaA has become almost impossible to use. Even though KaZaA proved to be the most "spoof-infected" P2P-network, similar networks are obviously suffering from this kind of junk, and it is getting worse. In this respect, the record industry's strategy has been a success. On the other hand for those users sharing bandwidth via a LAN where file sharers are active, it can become a nightmare.

The growing traffic category classified as "unknown" in Internet traffic studies can probably to some extent be explained by encrypted P2P traffic. The practice of filling networks with spoofs has encouraged this shift towards anonymity. The consequences of a shift, driven by content owners' actions, towards greater anonymity, ultimately resulting in numerous "dark nets", has to be taken seriously and analysed thoroughly.

New business models need to be developed which follow the principle of making popular activities legal (and finding suitable revenue streams) rather than embarking on a mission impossible to strangle them. This means the content industry needs to make legal services more attractive to the millions of current P2P users. Consumers have to be convinced of lawful services' preponderance, usability and range of choice compared to illegal alternatives.

Today high prices for digital content (compared to physical equals), complicated copy protections and incompatibility between systems (e.g. Apples iPod vs. WMA) are limiting the growth of the legal market for downloadable content. Open standards will make it possible for more players to join and facilitate competition.

References

[1] King, B (2000) Napster's File-Trading No More http://wired-vig.wired.com/news/business/0,1367,37558,00.html?tw=wn_story_page_prev2 (Acessed April 27th , 2005).

[2] Slyck.com (2005) http://www.slyck.com (Acessed April 27th , 2005).

[3] Sharman Networks (2003) Kazaa Media Desktop sets most downloaded software record http://www.sharmannetworks.com/content/view/full/191 (Acessed April 27th , 2005).

[4] Borland, J (2003) Judge: File-swapping tools are legal http://news.com.com/Judge+File-swapping+tools+are+legal/2100-1027_3-998363.html

[5] Libbenga, J (2003) Dutch Supreme Court rules Kazaa legal http://www.theregister.co.uk/2003/12/19/dutch_supreme_court_rules_kazaa/

[6] Borland, J (2004) Judges rule file-sharing software legal http://news.zdnet.com/2100-3513_22-5316570.html

[7] IFPI (2005) Music file-sharers face biggest round of legal actions yet; many are already counting the cost http://www.ifpi.com/site-content/press/20050412.html (Acessed April 25th, 2005)

[8] BPI (2005) Illegal filesharers pay thousands of pounds in compensation http://www.bpi.co.uk/news/legal/news_content_file_901.shtml

[9] Mennecke, T (2005) Bahnhof and Antipiratbyrån Settle Differences http://www.slyck.com/news.php?story=732 (Acessed April 30th, 2005)

[10] Mennecke, T (2005) Collection of Swedish IP Addresses Ruled Unlawful http://www.slyck.com/news.php?story=823 (Acessed June 22th, 2005)

[11] Antipiratbyråns´ surveillance of file-sharers found illegal (Swedish) http://www.datainspektionen.se/pdf/beslut/antipiratbyran.pdf (Acessed June 22th, 2005)

[12] IFPI (2005) IFPI applauds coming into force of WIPO Treaties, http://www.ifpi.com/site-content/press/20020620.html (Acessed June 25th, 2005)

[13] Maguire, J (2000) Hitting P2P Users Where It Hurts http://www.wired.com/news/digiwood/0,1412,57112,00.html (Acessed April 30th, 2005)

[14] Ingram, M (2005) Claim to end 99% of Illegal Treding http://www.slyck.com/news.php?story=750 (Acessed April 30th, 2005)

[15] Leyden, J (2005) MP3 zapping malware worms onto P2P network http://www.theregister.co.uk/2005/04/22/nopiracy_worm/ (Acessed April 30th, 2005)

[16] Sophos.com (2005) Virus information W32/Nopir-B http://www.sophos.com/virusinfo/analyses/w32nopirb.html (Acessed April 30th, 2005)

[17] Wunsch-Vincent, S et. al. (2005) OECD report DSTI/ICCP/IE(2004)12/FINAL, page 78 http://www.oecd.org/dataoecd/13/2/34995041.pdf (Accessed Jun 22th, 2005)

[18] IFPI (2005), Fact sheet - Facts on File-sharing, http://www.ifpi.org/site-content/press/20041007c.html (Accessed Jun 22th, 2005)

[19] Oberholzer, F et. al. (2004) The effect of file-sharing on Record Sales – An empirical Study http://www.unc.edu/~cigar/papers/FileSharing_March2004.pdf (Accessed June 22th, 2005)

[20] Patil, A (2003) Identifying Sources of Spoof Files and Limiting Their Impact in the FastTrack Network http://web.mit.edu/patil/Public/805project/#intro (Acessed April 30th, 2005)

[21] Cornell University (2005) Thwarting P2P Pollution   http://www.cs.cornell.edu/People/egs/credence/ (Acessed April 30th, 2005)

[22] Wunsch-Vincent, S et. al. (2005) OECD report DSTI/ICCP/IE(2004)12/FINAL, page 77 http://www.oecd.org/dataoecd/13/2/34995041.pdf (Accessed Jun 22th, 2005)

[23] Slyck (2005), http://www.slyck.com/stats.php (Accessed 26th June 2005)