City, University of London Institutional Repository

This is the accepted version of the paper.

This version of the publication may differ from the final published version.

Competing Against Online Sharing

Ramon Casadesus-Masanell
Harvard Business School, Boston, Massachusetts, USA

Andres Hervas-Drane
Universitat Pompeu Fabra, Barcelona, Spain

Purpose: This paper explores online sharing of copyrighted content over peer-to-peer (p2p) file sharing networks and its impact on the music industry, and assesses the viable business models for the industry going forward.

Design/Methodology/Approach: We analyze the evolution of the online content market over the years that followed the widespread adoption of p2p. The paper is based on a Teaching Case by the authors, and builds on two related academic papers that provide the theoretical underpinnings for the analysis.[1]

Findings: Based on the early developments observed in this marketplace and the aforementioned theoretical work we argue that it is unfeasible to fully eradicate p2p, and so the industry must embrace it by understanding how consumers derive value from the technologies that enable it.

Originality/Value: The developments analyzed here offer relevant insights for the online content marketplace, allow us to better understand the scope of strategies available to the music industry, and may provide lessons for other industries transitioning to online business models.

Keywords: Peer-to-Peer, File Sharing, Online Distribution, Music Industry, Business Models

Paper type: Case study

1. Introduction

Online sharing of content by consumers became mainstream with the release of Napster in 1999, and continued to thrive over subsequent peer-to-peer (p2p) file sharing networks such as eMule and BitTorrent. The phenomenon generated a public debate in developed countries over its impact on the creative industries, where business models were being transformed by online sharing and digital distribution. The music industry was arguably the most affected, since music recordings first spurred widespread adoption of file sharing on Napster, and was also the first to develop new online distribution channels for consumers to access and purchase music. The music industry´s response to online sharing thus presents an interesting case study to understand the business models that firms in the creative industries may adopt to confront the challenges brought by digitalization.

The literature on p2p file sharing has mostly focused on the technical aspects of p2p architectures. Some studies have explored the real-world performance of file sharing networks, such as the early work of Adar and Huberman (2000) and Asvanund et al. (2004). These studies measured the extent of congestion faced by file sharing users, which is mainly driven by users that freeride by consuming the resources provided by others without supplying any in return. A large body of literature has developed theoretical models to understand the performance of file sharing networks and deter freeriding, such as the contributions of Antoniadis et al. (2004), Cunningham et al. (2004), Feldman et al. (2004), Golle et al. (2001), and Ranganathan et al. (2003). While some of the solutions proposed

---

have been incorporated into p2p applications and improved their performance, the literature has mainly focused on p2p networks in isolation, without taking into account how they interact and compete with other content distribution models.

In economics, another strand of the literature has focused on the impact of file sharing on the sales of music recordings in physical formats (CDs). Contributions in this area include Liebowitz (2006), Rob and Waldfogel (2006), Obelholzer-Gee and Strumpf (2007), and Zentner (2006). Most of these studies have found that online sharing has a negative impact on sales. However, the literature has paid little attention to the interaction of p2p and commercial initiatives based on digital distribution. This is important because digital distribution is a closer substitute to online sharing than physical formats. In addition, digital distribution enables new business models that were previously unfeasible due to the constraints of physical distribution. Casadesus-Masanell and Hervas-Drane (2010) model the competitive interaction of p2p and digital distribution such as iTunes. In this paper, we build on this previous work to assess the viable business models for the music industry in the new digital environment.

We start by reviewing the fundamental characteristics of p2p file sharing in the next section, providing an overview of the technology and the main software applications that have driven file sharing traffic over the last decade, and discuss the economic factors that explain the success of file sharing networks. In Section 3 we review the music industry's response to online sharing, characterized by a legal campaign against online sharing users, intermediaries and software developers, and by the deployment of new online distribution initiatives. While several of these industry-sponsored initiatives failed to gain traction in the marketplace, Apple's iPod and iTunes combination was largely considered a success. We discuss how online sharing contributes to explain the different levels of success observed across these industry initiatives. In Section 4 we summarize the value propositions of p2p and successful industry initiatives such as iTunes, and conclude by reviewing the strategic implications for the industry going forward.

2. Background on Peer-to-Peer File Sharing Networks

Contrary to a client-server model, in which central servers provided resources or files for client computers, a peer-to-peer network referred to a network architecture in which all computers were interconnected to share resources amongst one another. In p2p networks, resources could be accessed directly from anyone in the network and a peer could act as both the provider and requestor of resources.[1] In p2p file sharing networks, individuals could search other people's computers for digital files, enabling online sharing of content on a large scale.

Individuals in p2p file sharing networks could choose to either share files or not. The first type of user, called a "sharer," made downloaded files on their PC available to others in the network. The second type of user, referred to as a "freerider," elected to not share any files on their PC. Users were engaged in "uploading" and/or "downloading," – uploading involved sending a file to others in the network, while downloading was the process of receiving the file from someone else in the network. Sharers were involved in both uploading and downloading, while freeriders would only engage in downloading.

Download speeds in a p2p network depended on the number of people in the network trying to access a file and on the number of sharers supplying the file and the speed of their Internet connection. In ideal circumstances, broadband connections permitted users to download a song (about three to four megabytes) in a matter of minutes, 100 megabyte file in less than one hour and a

high quality full movie motion picture (several 100 megabytes) in about three hours. Music files varied in format, and the most commonly traded format on p2p networks was MP3. MP3 was developed in 1997 and was the most popular file format for digital music offering near CD quality. Users could easily copy and listen to MP3 files on computers and dedicated MP3 devices with no playback restrictions, and could convert them to any other format without limitation.

As of early 2006, it was estimated that over 10 million users participated in p2p file sharing networks worldwide at any given time swapping over 10,000,000 GB (10 Petabytes) of data.[2] More than 500 million downloads of p2p file sharing software had been logged since 1999.[3] Bay TSP, an organization dedicated to tracking illegal file sharing, estimated that two of the top networks had five million users per day with access to a total of 750 million files.[4] Big Champagne, another organization tracking p2p usage, found that as of September 2005, 9.3 million users worldwide were logged onto p2p networks at any one time, up from 6.7 million in September 2004 and 4.3 million in September 2003.[5] Another study by CacheLogic calculated that 61.44 per cent of all files downloaded over p2p networks were movies and videos, whereas 11.34 were audio tracks and the remainder being made up of software and documents.[6] It was estimated that between 50 and 60 per cent of Internet traffic in Europe and the U.S. was accounted for by p2p file sharing.[7] While file sharing had greatly increased ISP's costs due to greater global traffic, it also stimulated broadband demand. ISPs had avoided taking any legal stand on the subject and had silently continued to upgrade their network infrastructure.

Client Software

We next provide a brief overview of the most popular p2p networks. The release of Napster in 1999 quickly brought p2p into the mainstream, and several generations of p2p software applications were subsequently released to improve on Napster´s limitations and capture a share of the growing p2p user base. The most successful were eDonkey/eMule and BitTorrent, although other notable networks include FastTrack (used by Kazaa, Morpheus and Grokster) and Gnutella.

Napster Created by 19-year-old Shawn Fanning in a Northeastern college dorm room in 1999, Napster was a software program that allowed users to swap music files. In Napster's design, a central server was used to index all of the users who were online at a given time. When one user performed a search, the central server would query all of the other users who had the file. The searching user was notified when a match was made, and that user could begin the download. p2p adoption grew quickly with the introduction of Napster, and from 1999 to 2002 Napster's software was downloaded 70 million times. One estimate believed that 85 per cent of U.S. college students were involved in some way with online music swapping at the height of Napster's popularity.[8]

Becoming the 'hottest' software on the planet had its downside, however. Record companies, musicians and the Recording Industry Association of America, a membership group aimed at protecting music copyrights, rallied together to contest Napster claiming that the network was seriously infringing copyrighted material. In 2000, Napster was ordered to be shut down by a San Francisco federal court.[9] Although Napster appealed the decision in early 2001, the appeals court upheld the prior ruling. Napster's ownership of the central server was seen as the final nail in the coffin. By late 2001, Napster had $101 million in liabilities (including past copyright fees to major record labels) and attempted to change its service to a subscription basis.[10] However, Napster did not manage to obtain the necessary licenses from the major labels, and finally sold its remaining assets to Roxio Inc. for $5 million.[11] The majority of Napster's users migrated quickly to other p2p networks.

Given the outcome of the legal proceedings, no other company had maintained a central server for a centralized p2p file sharing application.

eDonkey and eMule The eDonkey network was developed by Jed McCaleb in 2000 and began operation with central servers that were contributed and maintained by individuals, and not the author of the software as was the case with Napster. eDonkey was considered by industry experts to be efficient in maximizing network throughput and minimizing overhead traffic, allowing users to transfer larger files than in the past. As the network grew, an open-source project called eMule was initiated by Hendrik Breitkreuz with the intention of offering users enhanced features, such as a credit system to reward uploaders. eMule quickly became the number one software choice to link into the eDonkey network. eMule was an open-source community project and was supported solely by donations and the sale of merchandise such as the official eMule stuffed cuddly toy.[12] As the network continued to grow and the limited number of servers available became a bottleneck, the network migrated to a decentralized architecture where peers would directly query each other to search for files and initiate downloads. This architecture no longer required central servers, and was very difficult to shut down through legal means. Because users often connected and disconnected sporadically, speed and reliability of the network was not always great – but having no central hub it was very robust to attacks.

BitTorrent Developed by Bram Cohen in 2002, BitTorrent´s main advantage was speed, as users could download files at a quicker rate. This was enabled by a 'tit-for-tat' principle, meaning that a user had to upload in order to be able to download files.[13] As BitTorrent stated on its website, "The key to scalable and robust distribution is cooperation." (i.e. 'Give and ye shall receive!')."[14] Just like eMule, the BitTorrent development team lived off of donations from the user community and the sale of BitTorrent branded t-shirts.[15] BitTorrent implemented a very particular centralized p2p architecture. Content search was not implemented; peers had to obtain links to content from an outside source (a webpage or another p2p network, for example). The link allowed the peer to connect to a predefined server managed by the providers of the content, called Tracker, and request the specified content from other connected peers; no other content indexed by the Tracker was visible. In this sense BitTorrent was not a self-sufficient network (and some industry analysts thought that it should not be considered a network), but excelled at delivering high download speeds and sustaining performance under heavy demand.

Understanding the Success of p2p

Several reasons were sighted for users involved with file sharing as opposed to purchasing a CD or DVD. One, the majority of p2p software programs were free and aside from the Internet connection, no additional charge was levied for accessing or sharing files. Second, many individuals were able to find a certain song or movie as easily as performing a Google search. p2p users don't have to leave their home and the availability is 24 hours, 7 days a week. Third, users could access greater variety of content in comparison to traditional distribution channels, including materials such as live performances, rarities, or basement recordings not distributed widely. One example of this would be the Icelandic band Sigur Ros, whose popularity soared within the independent pop scene after their files were swapped on p2p networks. Fourth, there were no restrictions on p2p files – users could use the files as they saw fit. In a study conducted at MIT, the top three most important attributes for p2p users were considered to be "charges no fee," "is fast," and "is stable." The three least important were, "has points for uploading," "supports only legal files," and "has voice connection."[16]

It was estimated that broadly 70 per cent of users on p2p networks were "freeriders" i.e., they did not allow others in the network to access their files.[17] However, what would be the incentive to become a sharer and contribute to the network? Naturally, there would only be a few incentives. One may be a moral obligation of 'giving' in order to 'receive.' Another may be wanting to promote one's own personal collection – this is more important in smaller affinity communities (i.e., promoting one's own band or becoming *the* definitive source for a specific type of music) than swapping massive Top 40 hits. Contributing with one's free will, however, produces a high number of "freeriders" in big networks, and it is an empirical fact that freeriding worsens with network size, see Asvanund et al. (2004).

Sharing content is costly for users. Peers incur positive costs to participate in the p2p network; these are the costs of the computing resources and the bandwidth required to remain connected to the network until a download is completed. Sharers bear additional costs: possible expected costs of legal action against the peer, additional computing resources such as storage space, and upload bandwidth. When a peer in a p2p network decides to share content, he/she is effectively supplying two different goods. First, he/she provides content. Second, he/she is supplying upload bandwidth to the network, which alleviates network congestion. Obviously, the peer who shares does not benefit from the content that he/she is sharing as he/she already owns it. In general content is not a scarce resource on popular p2p networks, which tend to offer more variety than legal online alternatives. In the absence of social preferences (altruism and reciprocity for example), sharing has no direct benefit to the peer who shares. Sharing results in lower congestion if upload bandwidth is a scarce resource.

The decision to share or to freeride will be based on a cost-benefit analysis. Since the costs of sharing are larger than those of freeriding, if there are no additional benefits from sharing, most peers will freeride. Clearly, if only a few people share, then there will be limited content, which will hamper the usefulness of the network. If everybody was a freerider, p2p networks would cease to exist.

Freeriders create congestion on p2p networks. If only a limited number of people are sharing a file, then the queue for downloading that file increases when everyone else is a "freerider." In fact, if the network has only a small proportion of peers who share content, congestion can be so great that the network becomes unusable. Developers of p2p applications such as eMule and BitTorrent have striven to make sharing more attractive, implementing credit systems and "tit-for-tat" principles that reward sharers with higher download speeds. As a consequence, a larger proportion of users are "sharers" on these p2p networks as compared to others that did not implement such mechanisms, and this reduces congestion and makes more content available, contributing to their success.

Other developments in the industry may also contribute to increase sharing:

- Greater access to broadband Internet connections;
- Decreases in the cost of hard disk storage and computing resources; and
- The permeation of more sophisticated p2p software applications (anonymity may soon be possible).

These three developments render "sharing" less costly and, thus, contribute to the diffusion of p2p file sharing networks. Furthermore, the emergence of a peer-to-peer file sharing culture is evidenced by the growing number of webpages publishing and indexing content on these networks.

We summarize the above discussion using a causal loop diagram, as introduced by Casadesus-Masanell and Ricart (2010). Figure 1 illustrates the main factors driving value creation in a p2p

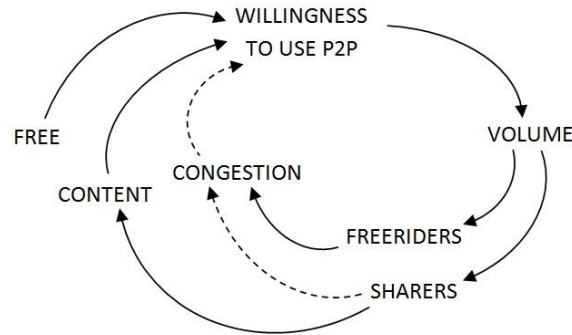network. Solid arrows indicate positive relationships and dashed arrows indicate negative relationships:

Figure 1. Dynamics of content provision and congestion in p2p file-sharing networks

To conclude our analysis of p2p, it is important to ask how many p2p networks we should expect to observe on the market. As of early 2006, there were four main networks: eDonkey, BitTorrent, FastTrack, and Gnutella. In the long term, the answer to this question will depend on the network effects present. In particular, is the value of a p2p network increasing with its user base? Or is there a point where the value gains in content variety are offset by the costs of increased congestion?

The trade off in a growing p2p network is as follows: A larger p2p network increases the variety of content available and this pushes the network towards a winner-takes-all dynamic. However, a larger p2p network also means more congestion, due to the increase in freeriding. Larger p2p networks also attract legal attention, and security decreases due to the potential presence of malicious peers (we further discuss this aspect in the next section). This limits the winner-takes-all dynamic. Thus if the population of users willing to participate in online sharing is sufficiently large, we should expect a number of p2p networks to coexist. While p2p networks also compete on ease-of-use and sense of community, we feel the above factors are the most relevant.

3. The Music Industry and Online Distribution

The music industry was approximately $40 billion worldwide each year.[18] The Recording Industry Association of America (RIAA) estimated U.S. retail sales to total $11.4 billion in 2004, down from the record breaking $13.2 billion in 2000.[19] Copious amounts of airtime had been given to p2p's effect on music industry players. Some industry participants felt that p2p file sharing was destroying the industry. The RIAA claimed that piracy cost the industry $4.2 billion each year on a worldwide basis.[20] Others, such as the Electronic Frontier Foundation (an organization offering intellectual and legal support to p2p software companies) and numerous consumer groups, felt that p2p represented unmatched possibilities and opportunity.

The Major Record Labels and the RIAA

There were four major record labels that controlled approximately 75 per cent of the worldwide market of wholesale music sales. They were Universal Music Group ($7 billion in sales), EMI Group ($4 billion), Warner Music Group ($2.5 billion) and the recently merged Sony BMG Music

Entertainment ($5 billion). The major labels had typically lagged in embracing past technologies dating back to the advent of the cassette tape. When the record labels saw that blank cassette sales were rising in the 1980s, the major labels claimed "home tapping is killing music," and lobbied for an extra tax on blank cassettes that would be distributed amongst the labels.

The RIAA was a membership group made up of U.S. record companies that sold roughly 90 per cent of all music and audio in the country. The RIAA was originally established in 1952, and became the central group responsible for collecting and distributing license fees and royalties on copyrighted audio material. As of 2006, the organization stated its raison d'etre: "to foster a business and legal climate that supports and promotes our members' creative and financial vitality."[21]

The RIAA had been at the centre of the battle against p2p networks, first starting with lawsuits against MP3.com in 1997, a website that facilitated the distribution of music in MP3 format, then Diamond Media in 1998 for their MP3 player and then Napster in 1999.[22] The RIAA continued on with lawsuits against other p2p software and networks, suing Kazaa, Morpheus and Grokster in 2001 but to little avail.[23] In 2003, a Los Angeles court ruled that Grokster was not liable for copyright infringement. In 2003, the RIAA had launched lawsuits against 261 individuals[24] and over 2,000 other individuals in the following two years, while enjoying some success in settling with individuals for copyright infringements.

The Grokster case rose to the U.S. Supreme Court and became known in the press as MGM v. Grokster, even though there were 28 plaintiffs with MGM (a motion picture company) taking the lead. In the U.S. Supreme Court decision in June 2005, the judges sided with MGM stating in the written ruling: "We hold that one who distributes a device with the object of promoting its use to infringe copyright ... is liable for the resulting acts of infringement by third parties."[25] The plaintiffs were delighted with the ruling and used the opportunity to launch more lawsuits against individuals.

The Industry's Online Distribution Initiatives

With the Internet, the major labels had been involved in promoting music online to varying degrees since 1995. Early on, all of the labels had set up corporate websites and had used the web to promote new albums and artists. All of the majors set up their own Internet initiatives to sell prepackaged CDs, teamed up with other online shops or attempted to offer digital music directly to consumers. Online initiatives included GetMusic, a joint venture between Universal and BMG and Total E, a joint venture between Sony and Warner. EMI took a different tack by purchasing part ownership in Musicmaker.com, an online site that offered custom CDs for $9.95 with $1.00 for each additional song. Musicmaker.com as well as the other initiatives did not succeed on the marketplace, however, and were rolled into other projects.

The next attempt was for the labels to team up to offer streamed or downloaded music for a subscription fee. MusicNet was made up of three majors Warner Music, BMG (at the time separate from Sony), EMI and Real Networks. Founded in 1999, MusicNet had two service packs offered in coordination with America Online (AOL): the first was for $17.95 per month giving listeners unlimited streaming to Billboard's Top 200 songs and permission to download and burn 10 tracks per month. The second pack was for $8.95 that allowed streaming only. When launched in 2003, MusicNet@AOL did not permit individuals to transfer music to portable devices. The service had captured 250,000 subscribers by March 2004[26] and had invited a number of new distribution partners such as Virgin Digital, HMV and Trans World Entertainment. Also, the merger of BMG Music with Sony Music meant that Sony had become part owner of the company. In April 2005, MusicNet was sold to Baker Capital, a private equity firm based in New York with $1.5 billion under management.

At the time of acquisition, MusicNet had 1.3 million tracks and offered its music through Yahoo, AOL and Virgin Digital.[27]

The second initiative was Pressplay – an alliance between Universal and Sony as well as contributions from Microsoft. When Pressplay was launched in 2001, it allowed music fans unlimited streaming and downloading for $9.95 per month. For $17.95, an individual could also make 10 portable downloads per month. The service was marketed through MSN, Yahoo! Music and MP3.com. In May 2003, Pressplay was sold to Roxio, a digital media vendor, for $12.5 million in cash and 3.9 million shares in Roxio common stock. Roxio had also purchased the defunct Napster and in October 2003, re-launched Napster as a subscription music service using Pressplay's infrastructure.[28]

The music industry's initiatives made heavy use of digital content restrictions. With the acceptance of the MP3 file format, the content industry and technology companies started developing digital protection systems, widely referred to as DRM (Digital Rights Management). Common types of DRM included digital watermarking, whereby the purchaser's information would be logged into the digital medium, and product activation, whereby the product could not be used until legally registered. Another form of DRM included encrypted codes on CDs and DVDs, which restricted copying or playing in certain regions. The goals were to provide consumers with digital music, while protecting copyrights.

Industry observers and consumer organizations critized DRM schemes as an opportunity for record and technology companies to try and establish a monopoly over digital music and reduce opportunities for music lovers to "fair use" of their purchased tracks. Pundits pointed out that without "fair rights" as part of the Copyright Act, demonstrations as simple as whistling a song on the street or quoting a line from the Simpsons to a friend over email could result in copyright infringement. They argued that "fair rights" were necessary for everyday life as well as future innovations and competition.[29]

Apple Computer: the iPod Digital Player and the iTunes Store

Borne from within the iconic computer technology company Apple, the iPod digital music player was released in 2001. Initially offered for $399 with the ability to store 1,024 songs, the iPod far exceeded the storage capabilities of competing MP3 players on the market at the time, which offered space for around 50 songs. The iPod launched together with Apple's iTunes online store to support this storage capacity, offering music lovers the opportunity to buy songs at $0.99 each.

In launching iTunes in tandem with the iPod, the CEO of Apple Computers, Steve Jobs, spent 18 months convincing record company executives that the music would be protected. Eventually, he got all of the "big five" to agree (at the time these were Universal, EMI, Warner, Sony, and BMG). Jobs idea was to give "revolutionary rights" to music consumers, meaning that after purchasing the song from iTunes, the listener could enjoy it with their iPod, load it on to their computer and make a CD of the tracks. The purchaser of an iTunes track was permitted to load the song on a maximum of five different computers or burn the song on a maximum of five CDs. There were no subscription fees involved, but iTunes tracks were restricted from being played on other MP3 players. Thus individuals filled their iPods with music from both iTunes and other sources – both legal and illegal. Out of the 42 million iPods[30] in existence, it was estimated that over 40 billion songs were in flotation of which 850 million had been purchased from iTunes as of the end of 2005.[31] All iPod models collectively sold 32 million units in 2005.[32] This meant that iPod controlled nearly 70 to 80 per cent of the digital player market.[33] While the iPod had profit margins of over 60%, songs sold through the

iTunes store were only marginally profitable to Apple but handsomely profitable to record companies.

The iTunes-iPod combination was a success, and quickly gained market share against competing third-party pay-per-download or subscription-based services. Figure 2 illustrates the main factors driving value creation and value capture in Apple's ecosystem:
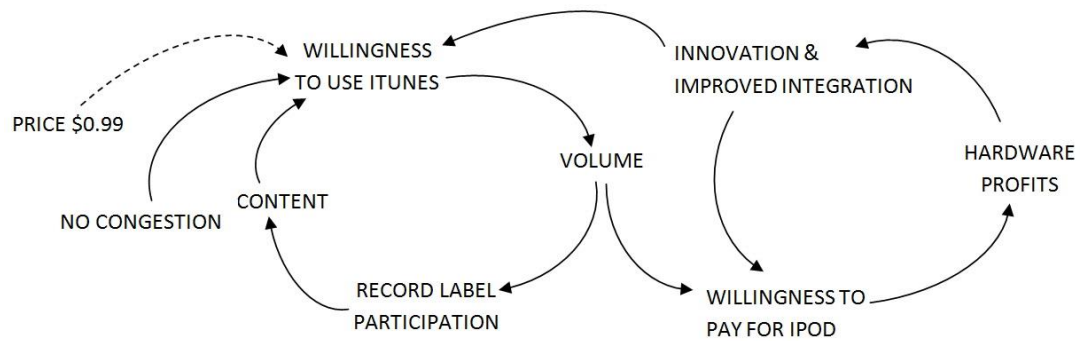

Figure 2. Apple's logic of value creation and value capture

In summary, Apple offered an easy-to-use system based on the seamless integration of hardware (iPod) and software (iTunes). This is substantially different from earlier approaches and those of competitors, which only had one (or promoted one) of the above components. The user experience was clearly at the center of Apple's strategy, and was continually improved with new versions of iTunes launched with each major hardware upgrade. Apple also garnered the support of all major labels and several prominent independents, positioning iTunes as the one-stop legitimate online shop for digital music. And it implemented transparent DRM management, satisfying the requirements of record companies while being transparent to the user, who was generally only aware of its presence when trying to perform an unauthorized operation.

4. Understanding How to Compete Against Online Sharing

Apple's solution became one of the most successful pay-for-download sites in operation, showcasing that it was possible for the music industry to compete against online sharing. As outlined in our discussion above, iTunes operated on a completely different premise than p2p networks, based on a client-server distribution model with tight integration of all stages of content delivery and consumption. Based on the successful iTunes model, we begin by summarizing the advantages and disadvantages of p2p vs. those of Legal Distribution:

p2p

Strengths	Weaknesses
• It's free • Variety of content • No restrictions on content (i.e, no DRM) • Constantly improving due to technological race • More people using it – increases availability of content and makes it harder to shut down	• It's under constant attack by industry players • Downloading time varies • Congestion problems (especially when network is large) • Sometimes content is unreliable (i.e., spoof files)

Legal Distribution

Strengths	Weaknesses
• Legal • Easy to use • High reliability • Metadata (i.e., information about the files) • Fast (i.e., no congestion problems) • Profitable for major labels • It has major label support • Better integration with music players	• Customers must pay – relatively expensive with respect to p2p • Restrictions on content • Variety of content is lower

The comparison reveals that neither of these content distribution models dominates the other in terms of user value created. We should nonetheless expect some attributes to evolve over time. For example, with improved access to broadband, p2p networks will become less congested. In addition, continued legal attacks from the industry against sharers (and perhaps government intervention) is prone to further erode their legality. For legal distribution, three trends are likely to take place: prices may fall due to competition among a growing number of legal sites; more content will be made available ("rarer" groups and recordings already on p2p); and DRM restrictions may be lowered to better compete with p2p (or alternatively, hackers keep cracking restrictions of use.)

To understand how Apple's business model interacts with p2p, it is useful to analyze the interconnection between their causal loops. Figure 3 presents a model of such interactions.
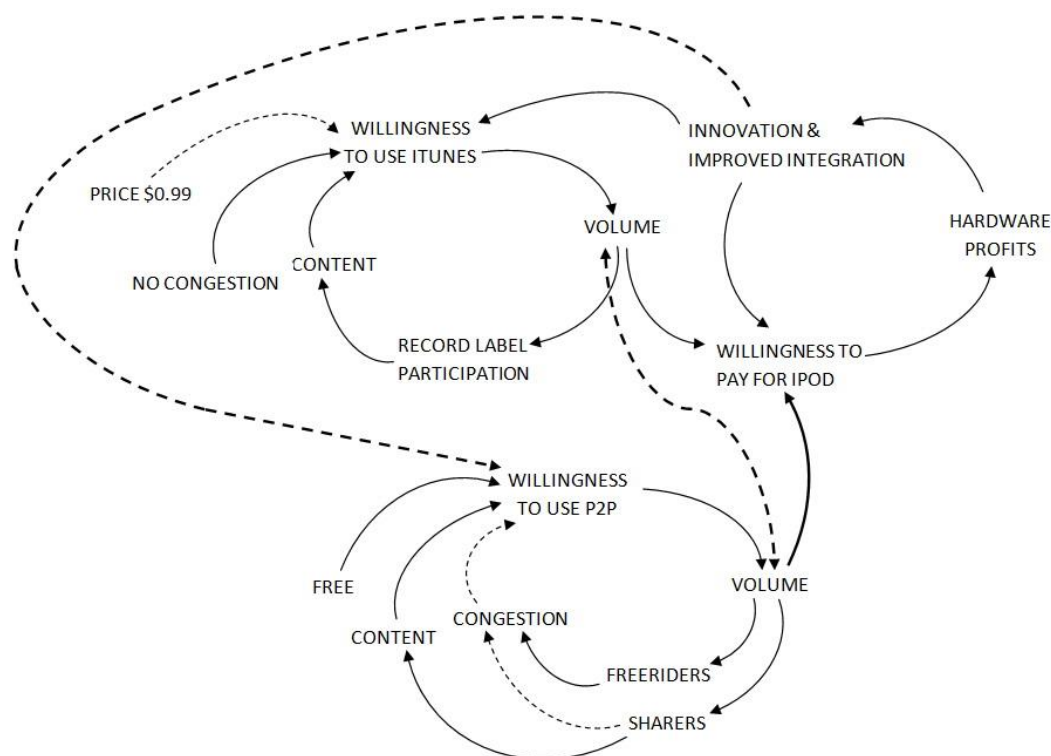
Figure 3. Interactions between p2p and iTunes

The representation reveals that Apple's ecosystem benefitted from p2p file sharing while simultaneously reducing its comparative attractiveness for consumers. It benefitted from p2p file sharing because a larger volume of p2p usage implied that more consumers had digital content that could be consumed on iPods, increasing the willingness to pay for Apple's hardware. It reduced the comparative attractiveness of p2p file sharing because a larger user base of iPods allowed Apple to continue to improve the iTunes store and its integration with the iPod, for example enabling the purchase of content directly from the device, introducing new content formats (e.g., videos, games), and personalizing the experience with content recommendations. This virtuous circle reinforced the attractiveness of the iTunes-iPod tandem in the marketplace.

Our review of the online content market's evolution and Apple's strategy suggests that there are two main avenues open to the music industry when competing against online sharing: to destroy it by legal means, and to embrace it in their business models. Since both avenues are not mutually exclusive, the industry should pursue both.

Could online sharing be eliminated? Towards this end, the industry could continue improving DRM, fighting p2p developers and users in courts, and working with ISPs and governments to block file sharing traffic. However, it is unavoidable that technology will continue to be developed to circumvent DRM restrictions and that p2p networks will prove resilient due to their decentralized architecture. Nonetheless, any reduction in p2p traffic or the content available on these networks would allow music industry players to appropriate a share of users' lost value, so partial success should not be interpreted as a failure.

To embrace online sharing and monetize music recordings when competing with a "free" good such as online sharing, the industry needs some key points to differentiate its offering - something that cannot be found in the free good. Apple's iTunes found a way to fulfill this need, proving that the new digital environment requires new approaches to commercial distribution. The industry could also focus on revenue streams from ancillary products that feed from the success of music recordings, such as live performances, merchandise, and advertising (product placement for instance). Online sharing should be recognized as an opportunity to expand these complementary markets.

Fully embracing online sharing calls for innovative approaches. By monitoring p2p activity, industry players can learn where and when content consumption takes place, gathering data that was not previously available over traditional commercial channels. This information could allow the industry to better fine-tune the touring of artists and the timing of commercial events. And besides trying to sell the tracks through download or subscription, the industry could also seek new content formats to capture value from music – music videos were created in the 1960s and became widespread in the 1980s, for instance. Are there no other forms of distributing music that lurk into the future?

References

Adar, E. and B. A. Huberman (2000), `Free Riding on Gnutella,' *First Monday*, Vol. 5.

Antoniadis, P., C. Courcoubetis, and R. Mason (2004), `Comparing economic incentives in peer-to-peer networks,' *Computer Networks*, Vol. 46, pp. 133-146.

Asvanund, A., K. Clay, R. Krishnan, and M. D. Smith (2004), `An Empirical Analysis of Network Effects in Peer-to-Peer Music-Sharing Networks,' *Information Systems Research*, Vol. 15, pp. 155-174.

Casadesus-Masanell, R., A. Hervas-Drane, and J. Mitchell (2006), `Peer-to-Peer File Sharing and the Market for Digital Information Goods,' *Harvard Business School Case* 706-479.

Casadesus-Masanell, R. and A. Hervas-Drane (2010), `Peer-to-Peer File Sharing and the Market for Digital Information Goods,' *Journal of Economics and Management Strategy*, Vol. 19, No. 2, pp. 333-373.

Casadesus-Masanell, R. and J. E. Ricart (2010), `From Strategy to Business Models and onto Tactics,' *Long Range Planning,* Vol. 43, No. 2 (Special Issue on Business Models).

Creus-Mir, A., R. Casadesus-Masanell, and A. Hervas-Drane (2008), `Bandwidth Allocation in Peer-to-Peer File Sharing Networks,' *Computer Communications*, Vol. 31, pp. 257–265.

Cunningham, B. M., P. J. Alexander, and N. Adilov (2004), `Peer-to-peer file sharing communities,' *Information Economics and Policy*, Vol. 16, Issue 2, pp. 197-221.

Feldman, M., K. Lai, J. Chuang, and I. Stoica (2003), `Quantifying Disincentives in Peer-to-Peer Networks,' *1st Workshop on Economics of Peer-to-Peer Systems.*

Golle, P., K. Leyton-Brown, I. Mironov, and M. Lillibridge (2001), `Incentives for Sharing in Peer-to-Peer Networks,' *Lecture Notes in Computer Science*, Vol. 2232, pp. 75+.

Liebowitz, S. J. (2006), `File Sharing: Creative Destruction or Just Plain Destruction?,' *The Journal of Law and Economics*, Vol. 49, No. 1, pp. 1-28.

Obelholzer-Gee, F. and K. Strumpf (2007), `The Effect of File Sharing on Record Sales: An Empirical Analysis,' *Journal of Political Economy*, Vol. 115, No. 1, pp. 1-42.

Ranganathan, K., M. Ripeanu, A. Sarin, and I. Foster (2003), `To Share or not to Share. An Analysis of Incentives to Contribute in Collaborative File Sharing Environments,' *1st Workshop on Economics of Peer-to-Peer Systems*.

Rob, R. and J. Waldfogel (2006), `Piracy on the High C's: Music Downloading, Sales Displacement, and Social Welfare in a Sample of College Students,' *The Journal of Law and Economics*, Vol. 49, No. 1, pp. 29-62.

Zentner, A. (2006), `Measuring the Effect of File Sharing on Music Purchases,' *The Journal of Law and Economics*, Vol. 49, No. 1, pp. 63-90.

Endnotes

[1] Rüdiger Schollmeier, "Signaling and Networking in Unstructured Peer-to-Peer Networks," Technische Universität München, PhD Thesis, September 2004.

[2] Andrew Parker, CacheLogic, www.cachelogic.com, Accessed August 24, 2005.

[3] Authors' estimates.

[4] "Combating Online Software Piracy in an Era of Peer-to-Peer File Sharing," Bay TSP Corporation, White Paper 2004, www.baytsp.com, Accessed August 16, 2005, p. 3.

[5] Simon Aughton, "p2p activity doubles in two years," www.pcpro.co.uk, October 11, 2005.

[6] Andrew Parker, CacheLogic, www.cachelogic.com, Accessed August 24, 2005.

[7] Ibid.

[8] Paul Gil, "Downloading Music MP3s: Peer to Peer File Sharing," netforbeginners.about.com, Accessed August 16, 2005.

[9] John Borland, "The evolution of file swapping," CNET News.com, June 27, 2005.

[10] Jim Hu, "Napster: Gimme shelter in Chapter 11," CNET News.com, June 3, 2002.

[11] John Borland, "Roxio closes Napster asset buy," CNET News.com, November 27, 2002.

[12] eMule Website, www.emule-project.net, Accessed August 19, 2005.

[13] How Stuff Works, Bit Torrent, computer.howstuffworks.com/bittorrent3.htm, Accessed August 18, 2005.

[14] BitTorrent Website, <www.bittorrent.com> , Introduction, Accessed August 18, 2005.

[15] Dawn C. Chmielewski, "A whole new world of file sharing," Mercury News, August 1, 2005.

[16] Jintae Lee, "Peer to Peer File Sharing Systems: What Matters to the End Users?" Massachusetts Institute of Technology, Sloan School of Management, 2004, p. 9.

[17] See Adar and Huberman (2000).

[18] RIAA website, <www.riaa.com>, Accessed August 20, 2005.

[19] Ibid.

[20] RIAA website, <www.riaa.com>, Accessed September 18, 2005.

[21] RIAA Website, <www.riaa.org> Accessed August 23, 2005.

[22] John Borland, "The evolution of file swapping," CNET News.com, June 27, 2005.

[23] Ibid.

[24] Lisa Bowman, "Labels aim big guns at small file swappers," CNET News, June 25, 2003.

[25] "File-sharing suffers major defeat," BBC News, news.bbc.co.uk, June 27, 2005.

[26] "Over 250,000 members join #1 on-demand Music Subscription Service…," MusicNet.com, March 30, 2004.

[27] "Baker Capital Acquires MusicNet," MusicNet.com, April 13, 2005.

[28] Russell Redman, "Roxio Acquires Pressplay Online Music Service," CRN, May 19, 2003.

[29] Fred von Lohmann, "Fair Use and Digital Rights Management: Preliminary Thoughts on the (Irreconcilable?) Tension between Them," Electronic Frontier Foundation, www.eff.org, Accessed September 22, 2005.

[30] Ibid.

[31] Ibid.

[32] Steve Jobs Keynote address, MacWorld San Francisco, January 10, 2006, Video, http://macworld.apple.com.edgesuite.net/mw/index.html

[33] "Samsung plans more MP3 players," Reuters, August 18, 2005.