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Technologies of Piracy? Exploring the Interplay Between Commercialism and Idealism in the Development of MP3 and DivX

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This article compares the development of the two central "piracy standards"—MP3 (sound) and DivX (audiovisual content)—analyzing the actors, strategies, and motivations involved in their inception and diffusion. Until recently, the main focus in the research literature investigating the relationships between commercialism and idealism in the development of the Internet has been on the clashes and confrontations between two supposedly incompatible worldviews. In accordance with newer approaches such as Castells and Cardoso's (2012) and Lobato and Thomas' (2012), we challenge this dichotomous and irreconcilable picture by investigating the borderlands and crossings between the two sides. As we argue, the cases of MP3 and DivX are strategic for beginning the exploration of these overlooked dynamics. The actor-network theory concepts of "displacement," "translation," and "immutable mobiles" are employed to trace the various phases in the propagation of the two standards. By following MP3 and DivX through their displacements and translations, we argue that they have come to form two different types of moveable objects, displaying and exemplifying some of the breadth of border-crossing dynamics.

The Interplay Between Idealism and Commercialism

In this article, we compare the development of the two technology standards, MP3 and DivX, through the 1990s and 2000s, investigating how actors with different interests and motivations have shaped the content of the standards and the social and technological arrangements in which they have become imbued. The two standards can be depicted as the central "technologies of piracy," each in their own field: MP3 in the field of online music distribution and DivX when it comes to the distribution of online audiovisual content. This distinction in itself makes a comparison between the two standards an exciting endeavor. Our basic research question revolves around the interplay between alternative, idealistic forces and commercial interests in the development of the Internet. A comparison between the developments of the two standards reveals a couple of surprising contrasts. We believe that these contrasts can be used to

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make some general points about the conditions for the transfer and the spread of standards and technologies as well as some more specific points regarding the interplay between commercialism and idealism in the development of the Internet.

Our comparison relies on two basic theoretical lenses. First, we use theories and concepts from the sociology of technology to analyze the processes of technology transfer. Second, to approach the role of MP3 and DivX within the history of the Internet, we will draw on historical, sociological, and political work in the field of Internet studies. More precisely, we will enter into a dialogue with studies that have analyzed the contradictions and interplay between idealism and commercialism in this connection.

The question of whether MP3 and DivX are technologies of piracy is, of course, related to the way both have come to be closely associated with the unauthorized distribution of content through file-sharing networks. However, even if this association might legitimize the labeling on a superficial level, it is our ambition to go behind such a vague notion through a study of the different groups of actors involved in the development of the two standards and the interests and motivations they brought along. The question of whether MP3 and DivX qualify as technologies of piracy will be scrutinized through the analysis—as indicated by the question mark in the title of the article. In other words, this is a research topic, not a mere statement.

We have coined the term "technologies of piracy" in connection to recent scholarly work on "piracy cultures" (Castells & Cardoso, 2012; Karaganis, 2011; Rodriguez-Ferrandiz, 2012; Spilker, 2012). The term "piracy" was originally coined by content industry actors to stigmatize and criminalize file-sharing activities. However, as David (2010) points out, Internet activists have "inverted the negative associations given to piracy and taken this term as a symbol of rebellion against corporate authority and its attempts to police the Internet" (p. 116). More broadly, Castells and Cardoso's (2012) concept of "piracy cultures" represents an attempt to move the discussion ahead of narrow definitions of legal and illegal. Their primary agenda is to address the implications of a situation in which "a very significant proportion of the population is building its mediation through alternative channels" (p. 3). Similarly, it is a way to approach the circumstance that a great deal of the innovation taking place on the net seems to occur outside of and in different ways than traditionally accepted ways of doing business and commerce.

The importance of the "alternative" in the development of the Internet was forcefully documented in Abbate's (2000) rigorous study *Inventing the Internet*. Abbate coins the term "culture of sharing" to denote that the alternativeness consisting of both a different, more idealistic type of motivation and a new approach to cooperation and communication. She locates the roots of the culture of sharing in the affiliation some important computer milieus developed in response to the countercultural movements of the 1960s and 1970s and the resulting rise of a "hacker ethic." The hacker code and culture of the 1970s has come to be seen as a precursor to not only the free software and open-source movements and their inclusive approach to computing but also the principles underlying peer-to-peer-based file-sharing systems and collaborative efforts such as Wikipedia and Indymedia (see Lievroew, 2011). Thus, it is fair to say that, compared to any other modern communication technology, alternative and idealistic forces have come to achieve a special prominence in the development of the Internet (see also Coleman, 2013; Kelty, 2008).

The tension between commercialism and such alternative and idealistic forces has been a major topic in Internet studies. The main focus in the research literature of the 2000s was on the clashes and confrontations between two supposedly incompatible worldviews (Boyle, 2008; Lessig, 2004; Vaidhyanathan, 2004; Zittrain, 2009). This research has undoubtedly revealed and mapped real conflicts of interest and has been crucial in raising awareness of the cultural and political stakes involved. However, perhaps as a mark of its origin in legal studies and its focus on court cases, there are reasons to suspect that it has drawn a distinction between two fronts that is somewhat too sharp.

In contrast to this, Abbate (2000) early described the Internet as the outcome of the concurrence and blending of various interests and motivations. More recently, other scholars have presented more nuanced pictures of these dynamics. Terranova (2004) was perhaps the first to pinpoint the ambivalent relationship between what she termed "free labour" and "netslaves." Other writers have shown that sides and boundaries are not always clear-cut and fixed when commercialism and idealism interact, sharing the same Internet distribution systems (see Leyshon, 2001). As companies over the last decade have built their businesses around user-generated content, it has similarly become paramount to rethink the distinction and dynamics between idealism and commercialism (see Gillespie, 2010; Jakobsson & Stiernstedt, 2010; Levine, 2011).

In practice, we know that, for example, the motivations and interests behind the development of some of the well-known file-sharing systems are actually quite divergent. According to Lievroew (2011), Shawn Fanning, the founder of Napster, "was no intellectual property crusader" (p. 108), but just a student who wanted to help his friends share music files. The founders of KaZaA, Janus Friis and Niklas Zennström, have stated on several occasions that their intentions were clearly commercial (see Munk, 2006). On the other side of the spectrum, the members of the think tank Piratbyräen (The Piracy Bureau) created The Pirate Bay as an explicit—as the name indicates—effort to support the free sharing of cultural artifacts and oppose prevailing regimes of intellectual property rights (see Kaarto & Fleischer, 2005).

To better understand the dynamics of the Internet, it is vital to closely investigate the movements and fluxes between idealism and commercialism when it comes to the development of standards such as MP3 and DivX. As we hope to show, some of these dynamics are better comprehended as relocations along a continuum rather than at opposite poles.

The Movement of Technologies Across Time and Space

This section presents the second pillar in our theoretical framework, which is drawn from the sociology of technology. DivX and MP3 are technological standards, meaning that they are a special type of technological artifacts. More thoroughly than others, Bowker and Star (1999) have drawn our attention to how standards have become an increasingly powerful—albeit often overlooked—ingredient in communication societies. They define standards as a set of agreed-upon rules for the production of (textual or material) artifacts. Furthermore, an important characteristic of a standard is that it spans more than one community of practice. It has spatial reach as well as persistence over time (Bowker & Star, 1999, p. 13).

When analyzing the development of the two standards MP3 and DivX, we will equip ourselves with a couple of conceptual tools drawn from actor-network theory (ANT), the most influential branch within the sociology of technology. This perspective is developed to offer tools for analyzing the interweaving of social and technical/"natural" elements in the construction of technological artifacts and scientific facts, hence making possible a description of phenomena as emerging relations between humans and technologies/materials (Latour, 1987; Law, 1994). According to ANT, it is not possible to read the significance of an artifact out of its technical specifications, but only through an analysis of the shifting social and material relations in which it has been embedded. These relations are called sociotechnical networks or assemblages.

We will pick up from actor-network theory three specific concepts. The first one is *displacement*. An artifact's movement in space and time can be understood as series of displacements. A displacement takes place, for example, when an artifact moves (back and forth) from a laboratory to a test panel, to a marketing agency or to different user constituencies. These situations are analyzed as potential sites for breaches in the development of a technology. Confronted with new social groups or new technical elements—for example, the merging of MP3 and DivX with the Internet—new associations and interpretations can be created.

Our second concept is that of *translation*. When an artifact is dislocated—put into new settings with other groups of actors—its uses, interpretations, materiality, and relations need to be adjusted in order for it to be appropriated. In ANT, these processes are called translations, which highlights that the direct or indirect negotiations taking place are a critical part of technology transfers. Through displacements and translations, new sociotechnical assemblages are created. More specifically, this happens through an intertwined process of renegotiations of the uses and meanings of the artifacts, the eventual reconfiguring of certain material aspects, and the establishment of new associations and relations with social and material elements to tie the artifact to the new setting.

To these two concepts we will add the concept of *immutable mobiles*. This literally means that things are able to move other things without themselves being moved. Latour (1987) uses the concept to denote an artifact that has become so established and stabilized that it is able to take the transfer to new sites and times and create new ties and relations without itself being challenged or changed. To become an immutable mobile is an effect that some artifacts achieve as a result of the sociotechnical processes they have already been involved in and the assemblages they already have become part of. Bowker and Star's description of the qualities of some ("successful") standards can be used to further illuminate the concept of immutable mobiles. They state that some standards "can have significant inertia and can be very difficult and expensive to change" (Bowker & Star, 1999, p. 14). Think, for example, of the QWERTY keyboard, which has been implemented in billions of typewriters and computer and smartphone keyboards and incorporated into the hands and fingers of billions of users.

To understand the concept of immutable mobiles, it is necessary to draw a distinction between material reconfigurations of the artifact itself and transformations in the artifact's sociotechnical contexts. In the case of MP3 and DivX, this means differentiating changes in the codes or algorithms that the

standards are based on and changes in the sociotechnical assemblages they are a part of. If an artifact has become an immutable mobile, the first one is unchanged while the second is expanding. This is in accordance with Latour's (1987) original conception, in which he suggests this type of technologies should be called "immutable and combinable mobiles" (p. 227). He elaborates: "The main advantage [of an artifact becoming an immutable mobile] is not only in the mobility it provides . . . but in the *combinations* it allows" (p. 226). To what degree have MP3 and DivX become immutable mobiles?

Our basic approach to answer this question has been to follow the technologies—that is, to follow the course of the technologies over time and identify the various types of actors connected to the technologies and the sociotechnical assemblages they have become part of. Because we have worked with related research questions for more than 10 years—Spilker with the commercialization of the Internet and the controversies surrounding digital music distribution and Høier with standardization processes and the digitalization of audiovisual content—we have been able to draw on acquired insight into and knowledge of the field. To undertake the analysis, we have relied on a re-analysis of existing research on the development of MP3 and DivX in combination with document analysis, primarily of a various set of net-based sources, including material such as published interviews, press releases, media coverage, encyclopedias, and tutorials. Additionally, we have used material from an interview with Dagfinn Bach, chief executive officer of Sygma AS, on Sygma's cooperation with Fraunhofer and the company's role in the development of MP3.

MP3's Route to Dominance

This section provides an account of the development of MP3 as a standard and a phenomenon, focusing on the central episodes of displacement and translation. In the early years of that history, there are at least two points that are important to make in this regard: (1) MPEG was not commenced with either audio or transmission primarily in mind, and (2) the standard was not an obvious solution.

It is natural to start the story with the formation of the Moving Picture Experts Group (MPEG) in 1988, a working group that was mandated by the international standardization organizations ISO and IEC to suggest standards for the storage of audiovisual content. The group was formed at the initiative of Leonardo Chiariglione, who had worked with video standardization in the European context for a long time, though with disappointing results, and who was impressed by the achievements of the expert ISO group, JPEG, in the field of pictures. Initially, the group consisted of 25 to 30 representatives from various industries in addition to some academic researchers. Among the industries were telecommunication operators, broadcasting companies, consumer electronics companies, computer manufacturers, terminal equipment manufacturers, and integrated circuits developers.

The group was starting to work on a package of standards that would become known as MPEG-1. The project concerned "video coding . . . for storage and retrieval applications on digital storage media" (Chiariglione, 2011b, p. 3). One of the important goals of the group was to foster the development of compression algorithms that rendered possible the digitalization of film for the compact disc medium. The commercial potential foreseen included a solution to the problem of long-term storage of film in archives and libraries.

The group initially worked primarily with video and had less competence in audio (Sterne, 2012, p. 140). However, a subgroup for audio was established in the autumn of 1988 under the leadership of Hans-Georg Musmann. The group issued a call for proposals and received suggestions for 14 coding algorithms from industrial players such as AT&T, Philips CE, France Telecom, and Fujitsu Limited. Through clustering and testing, the group ended up proposing three audio compression standards—Audio Layers 1–3, with subsequently more complex algorithms and higher compression rates (see Musmann, 2006). Layer 3 was based on patented algorithms by the German company Fraunhofer-Gesellschaft. The full name of this audio standard was MPEG-1 Audio Layer 3—later abbreviated as MP3.

In the usual accounts, MP3 is described as a compression technique that reduces the size of a music file to between 1/10 and 1/12 of its original size without a recognizable loss of sound quality, which is accomplished by simply removing the frequencies that ordinary people cannot hear anyway. This is an account with enough accuracy for most occasions—and one that makes MP3 seem to be the obvious solution. However, as Sterne's (2006, 2012) detailed accounts reveal, it took Fraunhofer years of research into psychoacoustics and information processing to reach the algorithms. Moreover, negotiations, compromises, and modifications in the MPEG group among the 13 other suggestions took even more years. At one point, Audio Layer 3 was almost discarded because of problems with the encoding procedures, which would cause "considerable implementation costs. So much so that, at that time, many considered Layer III as impractical" (Chiariglione, 2011a, p. 2). Audio Layer 3 was finally approved in November 1991.

MP3 was not primarily conceived with music in mind, but rather as part of a larger project on developing video standards. Nonetheless, within the audio group were people interested in audio-only applications, including the development of digital audio broadcasting. The Norwegian company Sygma, which was headed by Dagfinn Bach, was the first to experiment with the transmission of MP3 through the Internet in 1992 and, together with Fraunhofer, developed a very early MP3 player in 1993. Furthermore, realizing the potential in the combination of MP3 and the Internet, Sygma worked through the 1990s with the launch of a commercial online music service named MODE (Music on Demand) (see Spilker, 2004). Bach was convinced that the company had exclusive technological solutions and a future-oriented business model, and the initial negotiations with the record companies were also promising. But before the announced launch in early 1998, problems were piling up. As Bach explains, "Something happened with the licensing of the technology that put everything out of control. Suddenly, the MP3 encoders were everywhere" (D. Bach, personal interview, September 20, 2002).

According to our sources, what seems to have occurred is this: To demonstrate its potential, Arian Koster of KPN Research suggested in 1990 that MPEG develop a software implementation of the MPEG-1 standard. This required that all the partners in MPEG give away some of their code to the others. Chiariglione commented: "Frankly, I did not see at that time for what reasons anybody should give away part of his code, but it has always been my policy to not disallow something other people believed in" (2011a, p. 3). As part of this demonstration, the Fraunhofer team created a free program using Audio Layer 3 to compress digital music files. Katz (2010) describes the program as "a typical 'demo'—just good enough to give prospective industry users an idea of its potential" (p. 180). Meant just for circulation

inside MPEG and its associated circuits, the program was stored unprotected on a computer at the University of Erlangen in Germany.

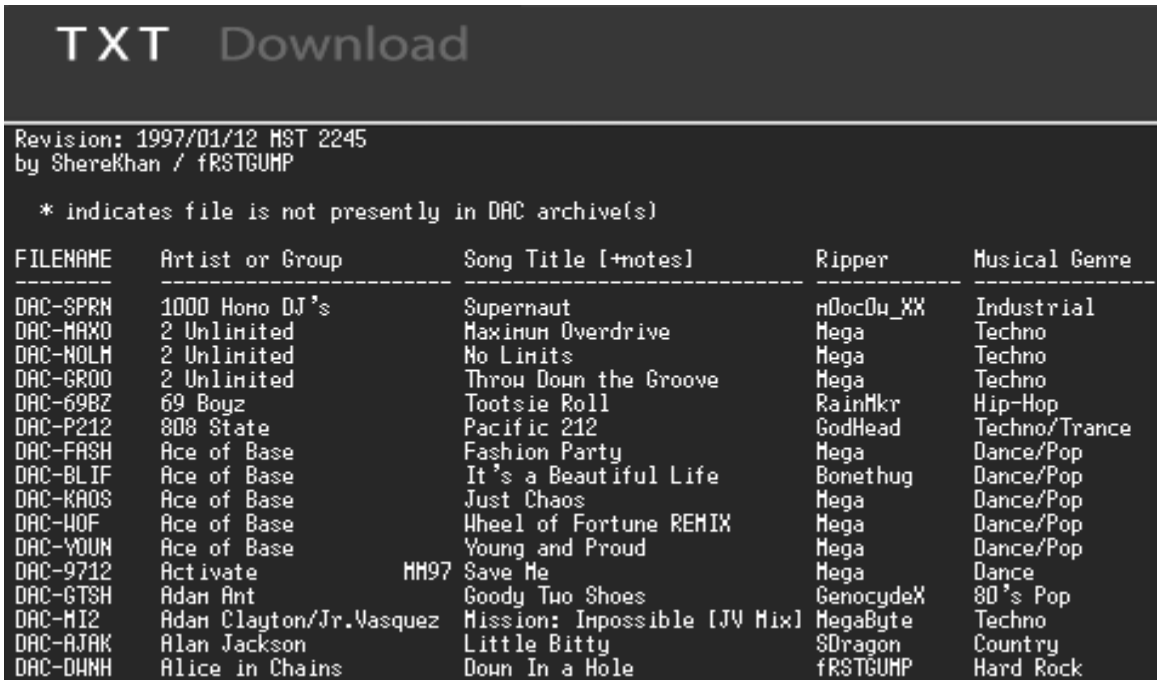
These kinds of unprotected solutions for encoding MP3 have often historically been reworked and redistributed by Internet communities. According to Katz (2010, p. 180), a Dutch hacker known as SoloH discovered the Fraunhofer demo, hacked it, and released what was then called mpegEnc on his website in 1993.[°] Similarly, according to Sterne (2012), an Australian hacker performed a "reverse engineering" solution called l3enc (p. 201). Others contributed with further refinements, working on the features they found most important. For example, while mpegEnc was known to have a (for that time) nice user interface, Swedish programmer Tord Larson's bladeEnc from 1994 focused on improving the encoding speed.[2] When Fraunhofer later released its own software solutions for encoding MP3 files, such as Winplay3 in 1995, this type of solution would also be redistributed among Internet users in modified or hacked versions.[3]

The years 1995 and 1996 saw the emergence of what came to be known as the "MP3 scene." With access to MP3 encoders, Internet users started to rip their own MP3 files from CDs and other sources and make them available on the Internet. So-called warez groups, at first operating openly, were competing to "release" music first and offer the widest assortment. The illustration in Figure 1, from the site of the group called Digital Audio Crew in January 1997, gives an impression of what such a site would look like. Note how the nickname of the individual "ripper" is indicated in a separate column. MP3 files began to circulate in various ways: on university servers, enthusiast home pages, IRC chat channels, "free webspace" services, and FTP servers (see Burkart & McCourt, 2006, pp. 46–48). Soon, more commercially oriented services such as MP3.com, GoodNoise, and MusicMatch began to appear, although the business model was uncertain. Basically, these sites offered a collection of links to various MP3 resources (see Morton, 2004, pp. 193–196).

[°] See http://www.euronet.nl/~soloh/mpegEnc

[2] See http://home.swipnet.se/~w-82625/default.htm

[3] See http://tiny.catpa.ws/a-short-history-of-my-part-in-the-early-mp3-scene



TXT Download

Revision: 1997/01/12 MST 2245
by ShereKhan / fRSTGUMP

* indicates file is not presently in DAC archive(s)

FILENAME	Artist or Group	Song Title [+notes]	Ripper	Musical Genre
DAC-SPRN	1000 Homo DJ's	Supernaut	nOocOu_XX	Industrial
DAC-MAXO	2 Unlimited	Maximum Overdrive	Mega	Techno
DAC-NOLM	2 Unlimited	No Limits	Mega	Techno
DAC-GROO	2 Unlimited	Throu Down the Groove	Mega	Techno
DAC-69BZ	69 Boyz	Tootsie Roll	RainMkr	Hip-Hop
DAC-P212	808 State	Pacific 212	GodHead	Techno/Trance
DAC-FASH	Ace of Base	Fashion Party	Mega	Dance/Pop
DAC-BLIF	Ace of Base	It's a Beautiful Life	Bonethug	Dance/Pop
DAC-KAOS	Ace of Base	Just Chaos	Mega	Dance/Pop
DAC-WOF	Ace of Base	Wheel of Fortune REMIX	Mega	Dance/Pop
DAC-YOUN	Ace of Base	Young and Proud	Mega	Dance/Pop
DAC-9712	Activate MM97	Save Me	Mega	Dance
DAC-GTSH	Adam Ant	Goody Two Shoes	GenocydeX	80's Pop
DAC-MI2	Adam Clayton/Jr.Vasquez	Mission: Impossible [JV Mix]	MegaByte	Techno
DAC-AJAK	Alan Jackson	Little Bitty	SDragon	Country
DAC-DWNH	Alice in Chains	Down In a Hole	fRSTGUMP	Hard Rock

Figure 1. Top of Digital Audio Crew's download site, January 1997.

Predating Napster were thousands of MP3 files available for downloading. In September 1998 it was reported that "MP3" had surpassed "sex" as the most popular search phrase on the Internet (Sterne, 2012, p. 206). Within one year of its release in June 1997, the popular, freeware MP3 player software, Winamp, received over 3 million downloads (Bronson, 1998). In 1998, the first stand-alone MP3 players, MPMan and the RIO player (see Alderman, 2001, pp. 58–59), were launched. Hence, there was already a vibrant "scene" at the time Napster was launched in July 1999, which was a precondition for the popularity the service would soon attain. Napster was the first service devoted exclusively to the sharing of music files in MP3 format between Internet users.

The end of the 1990s saw MP3 settle as the de facto standard for digital music distribution. Several competing standards were around at the time—such as Microsoft/IBM's WAV format, AT&T's a2b standard, standards developed by the start-up companies Liquid Audio and Real Audio, and advanced audio coding (AAC), which was later implemented in iTunes—but none of them managed to reach the same popularity as MP3. Neither did Vorbis, the genuine open-source alternative to MP3.

The use of MP3 continued to grow, even though the Recording Industry Association of America started to take legal action in the late 1990s against owners of FTP servers and solutions such as MP3.com and Napster. In the 2000s, the MP3 standard upheld its position as a "piracy technology" and was the dominant format for the distribution of music in file-sharing networks such as Gnutella, KaZaA, LimeWire,

and Pirate Bay. At the same time, MP3 increasingly, albeit reluctantly, received acceptance among commercial content providers. Liquid Audio was one of the first companies to cooperate closely with the record companies to establish a legal service for digital music distribution. Initially, its Liquid Music Player only handled files in a variation of the AAC standard using watermarking. However, due to market pressure, the company found it necessary to include support for MP3 on its software starting in 1999 (Alderman, 2001, pp. 40–46, 55). Much the same story was repeated some years later when Apple launched its iTunes service. For some years, songs bought from the iTunes Store came in AAC format with copy protection. In 2009, the company decided to remove the copy protection from songs sold in the store, with users gaining the possibility of converting the files they had purchased to MP3s. Meanwhile, in 2007, Amazon MP3 became the first online music store to sell songs in the MP3 format, while seven of the biggest British online retailers got together in 2008 to launch a joint logo signaling MP3 compatibility (see Figure 2).

Figure 2. The 100% MP3 compatible logo.

A debater at the Norwegian website hardware.no made the following apt comment: "It's not many years since MP3 was synonymous with illegality. That's strange to think back at now when these types of approval marks are introduced."[4]

The MP3 standard has moved back and forth between the commercial, formal economy and the idealistic, informal economy—and subsequently has been the object of several displacements and translations. The *first translation* occurred when MP3 started to be perceived as an audio standard in its own right. In a *second translation*, MP3/MPEG-1 went from being primarily about solving challenges connected to the long-term storage of sound and video to become a tool enabling the distribution of digital audio. During both of these translations, the MP3 standard was also displaced—connected to new groups of actors with other interests, including audio researchers, radio industry players, and, eventually, as with the case of Sygma, Internet developers. Nevertheless, the development of MP3 was still taking place within the rules of the formal economy.

It was with the *third displacement and translation* that MP3 embarked on its career as a piracy technology. Starting with SoloH's tinkering with the Fraunhofer demo and his development of the mpegEnc software, MP3 was transformed from an industrial product to a hacker object. Initially, the hackers' tinkering aimed at improving the encoding and decoding software. Gradually, though, the efforts became concentrated on finding effective ways to make music available online, as with the systems that

[4] See http://www.hardware.no/artikler/MP3-kompatibilitet-garantert/57671

the warez groups had invented for MP3 retrieval and, later, in the development and enhancement of file-sharing applications. Still, MP3 could have simply remained a toy for the techno-savvy. A *fourth transformation* occurred as an entire generation of ordinary Internet users appropriated MP3 as their preferred means for (freely) exploring and sharing music. Finally, in a *fifth movement*, MP3 was reinvented as a commercial product with portability as its primary sales pitch.

A central tenet in Bowker and Star's work—as well as for other sociologists of technology studying the development of standards—is that there is "no natural law that the best technology shall win" (1999, p. 14). The standards that end up achieving dominance do it for a host of reasons connected to the resources invested in them: market strategies, convincing work, ability to build on installed bases, and alliances. This is also true when looking at the history of the MP3 standard. The success of MP3 cannot simply be explained by technical sovereignty or lack of alternatives. Other factors must be taken into account, such as timing, the hackability of the encoding/decoding equipment, the affinity of the users, and the wide selection and portability of available MP3 files. The history of music distribution over the last 120 years has clearly demonstrated that no technological solution lasts forever. That said, the MP3 standard has clearly come to dominate the first two decades of Internet-based music distribution.

DivX: The MP3 of Video?

This section traces the various displacements and translations of the video standard DivX and describes the prominence of the interplay between commercial and idealistic forces. After releasing MPEG-1 and MPEG-2, the MPEG group published its first version of the third major standard, MPEG-4, in October 1998. This was an extensive standard for multimedia that included, among other things, new ways to compress video. Microsoft was one of the many participants in this standardization process, and the next year, in 1999, it launched three versions of a video codec under its own brand: MS MPEG-4 V1, MS MPEG-4 V2, and MS MPEG-4 V3. These three Microsoft codecs were all closely connected to the earlier efforts in the Motion Picture Expert Group, but only some of the video coding parts of the standardized MPEG-4 were included in the releases from Microsoft. The three MS MPEG-4 video codecs were again made interoperable with the proprietary Microsoft video solutions and existing file formats used by Microsoft. Hence, this initial development involved a partial implementation of the technology from the MPEG committee.

The first versions of DivX, called DivX;-) 3.11, involved a reverse engineering of the MS MPEG-4 V3 codec and were described as a hack in the release notes.[5] The hack involved an extension of the functionality for the Microsoft solutions. When Microsoft released its MPEG-4 V3 codec, it was released as a codec that could only be used in combination with the streaming file format known as ASF (created by Microsoft). The first DivX release made it possible to combine this codec from Microsoft with another

[5] DivX was described thus in the text that followed the first release (all errors are in the original text): "This is a Hack of selected version of the M$ MPEG4 codec FOURCC and CLSid code have been hacked so you can make ALWAYS WORKING AVIs."

solution from Microsoft, the video file format known as AVI.[6] The reverse engineering was performed by Jérôme Rota and a German hacker known as "Max Morice," and it enabled users to produce a file that could be both shared online and played back locally on computers (Bruegmann, 2006, pp. 9–10). The DivX release thereby involved a merging of two solutions that were intentionally kept separate by the proprietor. DivX enabled users to share videos by using the latest—and at that time, the best—Microsoft codec available. The history of these Microsoft solutions also meant that the initial standard from the MPEG committee was now displaced for a second time.

DivX primarily enabled two functions: By downloading the modified codec, users could effectively produce video files from different sources and play back such files on their systems. In more technical terms, this process is called encoding (or just coding) and decoding video files. First and foremost, the initial release was a video codec, but, again, this codec could be used together with encoding software and media players from other software producers such as Microsoft.

Despite the fact that the first release of DivX in 1999 only combined functionality from existing software solutions in a creative way, the name DivX was understood as an independent innovation by many online users. The solution would soon become a popular way to prepare video files for online sharing when ripping DVDs and sharing different sorts of film and video material. DivX became a problem-solving solution by making it possible to compress video files to manageable sizes within a format that could be downloaded and played locally, often by producing CDs.
The DivX solution was becoming an underground phenomenon, growing fast and backed by online users who can be described as hackers, innovators, and technical mentors. In retrospect, DivX itself explained that DivX was now "well on the way to becoming the MP3 of video."[7]

However, as described in the official company history, the DivX story soon took another turn in 2002.[8] At the beginning of 2000, Jérôme Rota was convinced by a former MP3.com executive, Jordan Greenhall, to team up and create a business around the DivX solution. The next logical step was fund-raising and development of the second software version, which at this stage was given the working title DivX Deux. Rota and Greenhall founded a company called DivXNetworks, and they were joined early on by Joe Bezdek, Tay Nguyen, and Darrius Thompson. During 2000, the new company recruited the first investors in the project and organized a software development project, this time under the name project mayo. A project website, projectmayo.com, and a company website, divxnetworks.com, were established,

[6] The initial name used in the first release in 1999 was DivX;), created by adding a "wink" to the name of a dispatched digital video format called Divx from Circuit City in the United States. The emoticon in the name was removed in the later releases. This text will refer to "DivX" as a collective term to avoid rapid shifts between DivX;) and DivX as the subject under study.

[7] DivX Networks: The official DivX 5.1 Guide, see document version 9/5/2004 at http://wayback.archive.org/web/20040615000000*/http://www.divx.com/support/guides/DivXGuide51.pdf

[8] See document version 10/3/2004 at http://replay.waybackmachine.org/20020310013140/http://www.divxnetworks.com/about/index.php

and the news media began to report more frequently on the developments. In the summer of 2000, *The Wall Street Journal* wrote about the ongoing developments in an article entitled "Web Piracy Is Hitting Hollywood Sooner Than the Studios Thought":

> Mr. Rota is busily working on a completely legal implementation of the DivX idea that won't use Microsoft technology at all. In fact, he was in San Diego this past weekend, meeting with American technology experts and financiers who are putting together a company to pursue digital video—one of several groups doing so. (Gomes, 2000, para. 6)

The goal for the Project Majo website was to facilitate the creation of a new software version that had no ties to the initial Microsoft solution but that could still be backward-compatible with the initial DivX release. A decision was made to go back to the solutions from the MPEG standardization process for the MPEG-4, and at the beginning of 2001 the company established a new open-source project called OpenDivX. This new development was undertaken to accelerate development toward the next DivX release and included yet another turn in the technology development by including open-source development.

This also meant that the OpenDivX project involved both commercial interests and idealistic mind-sets, and during the spring of 2001 this diversity resulted in major conflicts of interest. Open-source enthusiasts with an ideological attitude stood on one side, while company people stood on the other, and the center of the discussion was a new development, a source code called encore2, which was written by a DivXNetworks employee. This code was first published as an open source on the project's website in March 2001 but was soon removed from this site. The OpenDivX project therefore ended in a polarization between commercial interests and idealistic attitudes, with this dispute being a reminder of how commercial and idealistic forces may interact in different ways; they can sometimes be joined, but they also can function as competing actors with significantly different attitudes toward technology developments. However, in retrospect, the OpenDivX project can also be labeled as a success, resulting in two relevant solutions for the growing online communities that wanted to share video files. DivX released Version 4 later in 2001, and the XviD project—DivX in reverse—was founded as an open-source project, which was similarly a continuance of the OpenDivX project.

According to the norms of the file-sharing communities, DivX was the only acceptable video format in 2001 and 2002. At this stage, the technical performance of DivX was contributing to the spread of the solution, and there was rapid growth in the amount of content being encoded into this format. The technical threshold for producing a DivX file was lowered in 2001 by available software such as Vidomi, DVDx, EasyDivX, VirtualDub, and others (Hattenhauer, 2001/2002).

The historical starting point of DivX, being a hack, contributed to an initial credibility within file-sharing communities, though over time a growing number of opinion leaders also developed preferences toward competing solutions such as XviD. One example of a shift in attitude is that in 2005 the norm for video encoding within P2P had changed to strongly recommending the use of XviD, and the future use of DivX was actually banned. It is also clear that the beginning commercialization of DivX, particularly after

the disputes and release of Version 4 in 2001, was disliked by many early adopters, who started to think of DivXNetworks as "selling out" (Bowman, 2002).

DivXNetworks attempted to secure the relevance of DivX in the marketplace by continuously releasing new and better versions over the ensuing years. The first independent version of DivX, Version 4, was released in a beta version in the summer of 2001, in parallel with establishing the new website located at divx.com (Borland, 2001). Version 5 was released in the spring of 2002, Version 6 in the summer of 2005, Version 7 in 2008, and Version 8 in 2010. The open-source developments within XviD had a number of releases after reworking the initial source from OpenDivX, and, unlike DivX, all its releases were distributed under the GNU, or General Public License.

DivX experienced a lot of use in its first years as a company, but it also needed to find ways to turn this use into profit, and one of the commercial strategies that the DivX company tried to succeed with was a cooperation with the adware firm Gator, which was centered on a solution called Gator Advertiser Information Network. DivX released three different versions of DivX Version 5, one that was free and two alternatives for procuring the "pro" version. Users had to watch occasional advertisements as a term of use for the pro version, or they could acquire the same extended functionality by paying for it or by choosing a reduced functionality (the free version). This solution around adware was a much-discussed issue online, and the business cooperation with Gator that started in the spring of 2002 with Version 5.0 ended in the summer of 2004 with the release of Version 5.2.

Another commercial strategy that was far more popular among DivX users was building alliances with electronic manufacturers that enabled the playback of DivX movies on stand-alone DVD players, mobiles, set-top boxes, and other hardware solutions. This strategy started in 2002 with a cooperation around a brand of DVD players called KISS, and in 2005 the company, which was now called DivX, Inc., claimed to have over 175 consumer electronics partners and more than 30 software partners (Stam, 2005). On the software side, this type of cooperation also enabled new ways to encode DivX files.

DivX, Inc. continuously attempted to show how its solution could be put to use within commercial services and to separate itself from the historical background as a hacked solution. The company also developed solutions for Digital Right Management (DRM) to compete with solutions from Microsoft, Adobe, Apple, and others when it came to presenting video within commercial Internet-based solutions.

Some of these business strategies clearly resulted in a decrease of DivX credibility within online communities, particularly when it came to strategies such as user payment, the use of adware, the development of DRM, and the company's many efforts toward cooperation with mainstream media. Nevertheless, the accumulation of DivX encoded content still contributed to pushing these video solutions forward, which it does even today, although nowadays there are also other relevant and competing formats such as XviD. Being free and based on open source and a more idealistic attitude, the solutions from XviD have turned out to be a popular technology within online communities.

DivX has been described numerous times over the years as "the MP3 of video," but its use today no longer justifies such a label. However, the history of DivX did culminate in a commercial success for its

founders when DivX, Inc. was acquired for about $323 million by Sonic Solutions in the summer of 2011. Commenting on the acquisition in the form of a press release, the two companies emphasized Digital Rights Management:

> The acquisition of DivX brings Sonic a vast installed base of CE devices, all of which ship with Digital Rights Management (DRM) for the secure playback of Hollywood movies even when not connected to the Internet. DivX's DRM, an important ingredient for the secure distribution of copyrighted video content, has been approved by major Hollywood studios.[9]

A solution that initially was thought of as a hack for pirates had turned into a commercial and mainstream solution that was now developed with content from the Hollywood studios in mind.

DivX has been embraced by new groups of actors and subject to different interpretations throughout its course. Similarly to MP3, DivX has a history related to the standardization work in the MPEG association through the proprietary variant MS MPEG-4 V3, which Microsoft had drawn out and refined on its own. DivX initially started as a sort of crack in the form of reverse engineering of this Microsoft standard. In the first phase—the *DivX ;-) phase*—the standard was constructed as a subversive technology and an underground phenomenon (as symbolized by the winking emoticon). Entering the *OpenDivX phase*, the standard was translated into a more "housebroken" development project by getting rid of the remnants of the Microsoft code, while trying to reap the benefits of the inclusive collaborative practices of the open-source culture.

DivX had become a popular way to prepare video files for online sharing within piracy cultures. However, the DivX founders were about to develop other ambitions for the standard. Even if it was legal, the OpenDivX project met considerable skepticism in industrial circles. In 2001, the OpenDivX project stagnated when the company withdrew the encore2 source code from the project's website. This signaled the start of the *DivX business phase*, in which DivX was translated into a proprietary standard in an attempt to enroll commercial groupings from the film and television industries. As a part of this reorientation, DivX, Inc. tried out different strategies through the 2000s such as bundling the software with adware, launching pro versions, and implementing copy protection features. Nonetheless, the reorientation, not surprisingly, was met with harsh resistance from many of DivX's original supporters, thereby resulting in the fragmentation, or "forking," of the standard. The *XviD development* represented a counterstandard and an antiphase to the new direction and has emerged as a real challenger to DivX.

On Reluctance and Courting

The starting point for this analysis was the position of MP3 and DivX as central technologies of piracy in the fields of music and video. A comparison of their life stories was used as a prism to shed light on the notion of piracy and its relevance for the development of the Internet and digital media. We have focused our investigation on episodes of displacement and translation, attempting to come to grips with

[9] See http://blog.roxio.com/press/webdivisiondivx/2010/10/sonic_completes_divx_acquisition.html

how the standards of MP3 and DivX—understood as cultural, political, and economic artifacts—have developed.

Both standards have undergone several episodes of displacement and translation, and, in some respects, the development histories of MP3 and DivX resemble each other. They have in common intimate connections with the standardization work in the MPEG consortium (the work on MPEG-1 and MPEG-4, respectively). Through displacements and translations, both moved from this origin to a significant hacker phase, which constituted the standards as technologies of piracy.

Still, there are some important differences, and to clarify such differences, we find it useful to draw on Jordan's (2008) distinction between two main types of hacking: (1) cracking, which is about breaking various forms of code systems and security solutions, and (2) open-source development, which is a matter of developing alternatives to proprietary software solutions (by legal means). In contrast to DivX, which included both types of hacking, MP3 never really went through a cracker phase, nor has it been, at least in an explicit sense, an open-source project. Furthermore, it has only been to a very limited degree that the actual standard has been a hacker object at all, even though it should be mentioned that net users played an important role in establishing metadata solutions (ID tags) for the MP3 format (see Morris, 2012). In the case of MP3, the tinkering mainly has been concentrated on the procedures of encoding and decoding and transmission, while with DivX there has been a continuous development of the core compression code. Looking at the incidents of the past 10 years, another difference is prominent: MP3 has gained commercial acceptance with no further modifications. By contrast, DivX is still a productive and generative label but has failed to reach any type of universal recognition.

Latour's (1987) concept of immutable mobiles can be used to elucidate these observations. Latour coined the term as a way to approach the enduring influence that some technologies come to exert. This influence is rooted in their mobility—their ability to move across time and space—and in their combinability—the way they allow new sociotechnical practices and assemblages to be formed. Or explained differently, it is a result of the way they lend themselves to displacements and translations while not being transformed, at least materially speaking.

We argue that MP3 is a solid example of an immutable mobile. After the initial approval of the standard within MPEG in 1991, only two minor adjustments have officially been implemented to the standard in a revision of MPEG-1 in 1995. The ID tags added by the Internet community at approximately the same time also have largely become recognized parts of the standard. In addition, the standard has remained remarkably stable. Why did MP3 become an immutable mobile? We have already dismissed that the explanation primarily lies in the simplicity and obviousness of the standard, with reference to the politics, complexities, and uncertainties involved in the developmental work (cf. also Sterne, 2012). Instead, it must be sought in the way that MP3 came to be part of a growing number of sociotechnical practices and assemblages throughout the 1990s: all the enthusiast efforts that resulted in MP3 being part of encoding software, warez sites, amateur and professional link collections, all sorts of music players including mobile devices, file-sharing networks, and search engines. This made MP3 a virtually self-propelling entity, paving the way for the commercial acceptance—more precisely, acceptance from the music industry—that we have witnessed later.

As we have seen in following DivX from phase to phase, it has obviously been a mobile technology. Yet, compared to MP3 (or to its own potential), the standard has experienced a somewhat restricted mobility and combinability. Today, DivX (and XviD) is only one (two) of several competing standards for the distribution of video. The lack of a more general compatibility can make it difficult for most users to obtain an overview of what type of equipment they can use for encoding and retrieving DivX (and XviD).

We understand this restricted mobility and combinability as a consequence of the circumstance that DivX has never managed to become immutable. To the contrary, DivX has been a *permeable technology* through its entire life course, as expressed by the continuous altering and rewriting of the specifications of the standard. This permeability has made DivX highly unstable, vulnerable to shifting interests, torn back and forth, and ultimately fragmented. Moreover, it is reasonable to point to the withdrawal of the source code for encore2 as a decisive moment in this connection. From a period in which DivX could enjoy general enthusiasm within piracy cultures, this move resulted in a resistance and search for alternatives among hackers and file sharers.

We will finish this article by reflecting on the way both MP3 and DivX have been moving back and forth between idealism and commercialism. Despite all the differences between MP3 and DivX, if we simplify their life stories, both developments can metaphorically be described as pendulum movements between commercialism and idealism, beginning with a commercial phase, swinging to an idealistic phase, and then swinging back again to a commercial phase. As we have seen, MP3 moved from its MPEG existence to piracy existence through a slip and returned to the formal economy by more or less letting time work, while DivX was transformed from a MPEG/Microsoft standard to a technology of piracy through a hack and was re-created as a commercial entity through a conscious (but not necessarily wise) move. Hence, both have made the movement between commercialism and idealism twice, albeit in different ways. A main point emerging from our analysis is how both technologies are the result of the interplay and exchange between more commercially and more idealistically oriented forces. With regard to this, we are in accordance with David (2010), who notes that the Internet today is the outcome and combination of "commercially motivated innovations . . . as well as more hacker induced innovations" (p. 31). The cases of MP3 and DivX are particularly interesting examples of such combinations because the public perception of both technologies is so strongly connected to the notion of piracy.

Of course, the pendulum metaphor also represents a simplification of the developments. The relationships between the commercial and idealistic forces have been much more complex and intertwined. For example, there also existed commercial ambitions and attempts for DivX in the OpenDivX phase, as there were in relation to MP3 in its formative years in the mid-1990s. And the other way around: MP3 is still the most important format for the informal distribution of music, and it still circulates video in the DivX format in file-sharing networks. Therefore, the relationship is not only an either/or but also a both/and. These nuances are important for understanding how closely idealism and commercialism sometimes become intertwined. This will help us achieve a better understanding of hacker and piracy practices.

In making these points, it is not our purpose to suggest that more persistent idealistic efforts do not exist. Indeed, the events we have described related to the forking of DivX and the development of the counterstandard XviD are in themselves examples of the opposite. However, until recently, much of the research literature concerning hacking, piracy, and the relationship between idealism and commercialism more generally has drawn boundaries between the two poles that are sharper and more insurmountable than is often the case. On the other hand, we have the somewhat reductionist analyses of, for example, Terranova (2004) and Levine (2011), who suggest that all alternative and countercultural forces in reality are "netslaves" tricked by Internet companies to perform free labor. In both cases, it has been difficult to see the interplay and fluxes that are important for understanding the contemporary dynamics of the Internet. We agree with Lobato and Thomas (2012), who call for a more realistic (and less idealistic or fatalistic) analysis of the relationships between what they call the formal and informal economy.

To accomplish this more realistic analysis, studies are needed that inquire more deeply into the combinations, interplay, fluxes, and dependencies between these forces. Subsequently, a more temporary and contextually situated picture of hacking and piracy will emerge. In this study, we have attempted to shed light on these issues by investigating two technologies of piracy. Other ways to approach this would be to follow (strategic) practices, individuals, or organizations. To justify their research engagement with "piracy cultures," Castells and Cardoso (2012) explained the importance of understanding whether these "might either evolve toward new institutionalized market practices . . . or remain as counter-cultural movements" (p. 827). In this respect, our contribution has been to show how two technologies have made the crossover to new institutionalized practices—and to show the mutually very different manner through which they have done so. One made this crossing through reluctant acceptance; the other made it through shameless courting.

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