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## DRMs, Innovation and Creation

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**Abstract:** DRMs are intellectual property institutions. They transpose the empirical principle of copyright, which implicitly recognizes that specific ownership rules should be attached to non scientific creation, into the digital era. The legal protection of DRMs, a private means of enforcing content excludability, participates in the "privatization" of copyright protection. This, in turn, means that a proprietary software — governed by intellectual property rights, reinforced by public law — becomes the key to the vertical relations shaped by exclusive copyright. DRMs consequently represent a major stake in the competition to capture network effects in the content distribution vertical chain.

**Key words:** copyright, distribution, DRMs, network effects

**D**igital Right Management systems (DRMs) are commonly perceived as technical nuisances invented by content owners to prevent consumers from fully enjoying the enhanced benefits offered by a digital age. This ridiculous function explains the painful roll-out of DRMs, which can, in the best case scenario, be dismantled by avant-garde information technologies such as media players, laptops, broadband open networks and peer-to-peer software. The content industry is renowned for shying away from innovation, and for running to court to protect its rents. Everyone recalls how ruthlessly the studios sued the consumer electronics industry thirty years ago in an attempt to block the roll-out of VCRs. And how, in the end, they lost and were forced to adapt as a result.

From an economic standpoint, it is widely accepted that innovation proceeds through a Schumpeterian destructive-creation whose effect is to abolish rents from obsolete systems, thanks to inventive technical or economical solutions. That vision implicitly applies to physical distribution systems for content, such as music records or DVDs, justifying the massive circumvention allowed by innovative information technologies. DRMs are often seen as a harmless trick to block that process.

In fact, DRMs are intellectual property institutions. They transpose the empirical principle of copyrights, which implicitly recognizes that specific

ownership rules should be attached to non scientific creation, into the digital era. Those rules constitute the economic basis of the creative industries that provide expensive, useful and enjoyable mass consumption information goods. Unlike patents, creative goods are not rendered obsolete through scientific innovation or additional creation. They therefore need to be effectively protected; otherwise the innovation process is distorted by false signals of intellectual property theft. In other words, the destructive-creation process leading to economic innovation should not be biased by systematic creative property destruction. Yet it is because there are two sets of industries involved in the process.

On the borderline between innovative and creative industries, the story of DRMs clearly illustrates the conflict of interests inherent to that situation.

## ■ Copyright principles

Cultural contents are the only information goods that are simultaneously experience goods. Their experience dimension — one needs to consume them before gaining knowledge of them, nobody knows their market in advance — has far-reaching implications in terms of production, marketing and financing. We will not look at this topic in greater detail here, focusing instead on the information dimension of DRMs. However, it is worth remembering that their consumption via experimentation makes contents economically different from many functional information goods such as software programs or patents.

As information goods, contents have been characterized since the seminal paper of Arrow in 1962 by the two major properties of public goods: non-rivalry and non-excludability. The consumption of a non-rival good by an additional person does not decrease the amount available for others. Given the nullity of its marginal cost, it should be priced at zero to reach maximal social welfare. A good is non-excludable when it is impossible to prevent someone consuming it, even when s/he does not pay anything for it. Non-excludability induces a deficit of incentives to create as producers anticipate underpayment.

Incentives to create can be re-established in two ways. A first possibility is to reward content producers through public remuneration schemes based on tax revenues or levies on ancillary products. The second solution is to rebuild excludability on contents. Copyright laws reward content owners with

exclusive rights to reproduction, distribution, representation, adaptation and translation, but for a limited period. This is the result of a trade-off aimed at maximizing social welfare, balancing incentives to create that would require infinite protection against the benefits of cultural diffusion that would require no protection at all.

Private Technical Protection Measures (TPMs) supplement copyright laws with self-enforcing access and copy control measures. Access control measures enforce consumers to pay to access content. The general idea is simple: the information good is bundled with some private good that gives its properties of excludability and rivalry to the entire bundle (VARIAN,1998). The content may be bundled either with physical supports (books, newspapers, tapes, CDs, DVDs) or with tickets (concerts, movie projections, pay-TV broadcasts) to form what Watts (2000) calls "delivery goods and services." Concurrently, copy control measures define consumers' freedom of use. These technical protection measures are not only private, but also cooperative: they have to be adopted simultaneously by the content industry, its distribution networks – including, of course, terminal equipment - and end consumers.

The exclusive copyright system is the result of these two principles: a public principle (copyright laws) and a private principle (TPMs).

Copyright laws not only constitute the basis of content protection, but also inform the industrial organization of content industries. They enable a better allocation of decision rights along the different segments of the vertical chain. Vertical selection and financing mechanisms are based on exclusive copyright. This is also necessary to segment content markets into different territories and versions.

## ■ DRMs: a digital copyright principle

Digitization embodies the theoretical public good nature of contents in a highly concrete form: each copy is an original and each consumer a potential broadcaster. This change of status has turned into a social phenomenon, with the surge of broadband networks and PC equipment as content distribution systems. Copyright issues have changed: the number of potential diffusion channels is growing together with threats to content owners' revenues and incentives to create. Moreover, the massive content circumvention trend questions individual prosecutions in terms of costs and

of social acceptance. Following the 1996 WIPO Treaties, the European Union and the United States adopted digital copyright laws, EUCD <sup>1</sup> and DMCA <sup>2</sup>, that shifted the balance of the exclusive rights system with a "radical innovation," namely the legal protection of DRMs.

Digital Rights Management systems (DRMs) refer to digital access, copy and redistribution control mechanisms for copyrighted contents such as music, video or text. They can be used either on physical supports (like DVDs) or on purely digital files. DRMs control access to digital content files: they are the entry ticket bundled with digital songs, texts and movies that make them excludable. Early examples of DRMs like the Serial Copy Management System for digital audiotapes or the Content Scrambling System (CSS) for DVDs were just copy restriction tools. But DRMs can also control the freedom attached to digital contents. They assign a pre-defined and self-enforcing set of uses to each item of digital content covering rights to view (hear), modify, record, excerpt, translate into another language, keep for a certain period, distribute, etc.

Given how hard it is to sue individual circumventors, without DRMs each consumer would exercise complete control over the exploitation of digital files. The legal protection of DRMs — a private means of enforcing content excludability — is part of a "privatization" of copyright protection. This makes proprietary software, governed by intellectual property rights and reinforced by public law, crucial to the vertical relations shaped by exclusive copyright.

## ■ Content distribution systems

Contents are distributed to the end consumer through systems consisting of delivery infrastructures (physical retail, broadcast, broadband, mobile etc.) and via terminal equipment. All devices that enable consumers to select, receive, render and store contents, be they fixed or mobile, are pieces of content distribution systems. According to this definition, contents and all delivery equipment are complementary goods. The systemness (Rosenberg, 1994) of digital content distribution comes from the need for technical interoperability between each link of the vertical chain.

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<sup>1</sup> EUCD: European Copyright Directive (22 May 2001).

<sup>2</sup> DMCA: Digital Millennium Copyright Act (1998)

All types of information systems are subject to powerful "network effects" - also called bandwagon effects - whereby users' benefits increase with the number of users. Network effects include "direct" effects, which are directly proportional to the number of users (fax or telephone services), and "indirect" effects mediated by a market such as complementary products, for example: the music ringtone industry indirectly benefits from GSM network effects; while MS Windows indirectly benefits from the effects of the internet network. Moreover, direct network or bandwagon effects also occur in experience or fashionable goods such as contents, where the testing of the good by early adopters increases its value for other consumers. For each Harry Potter fan, the utility of the movie increases with the number of fans s/he can exchange with.

LEIBENSTEIN (1950) was the first economist to stress the importance of bandwagon effects on the demand function. ROHLFS (1974) modelled the network effects through an aggregated demand curve. He showed that there is a critical mass of subscribers below which a network cannot be sustainable. Before this mass is reached, any resignation brings the willingness-to-pay of the remaining members under the price of the service. Any equilibrium is instable. Once critical mass is reached, the utility of all consumers stands above the price of the network. Moreover, every new consumer brings additional utility to all the others. The main issue is consequently how to achieve critical mass? One rule of thumb is to subsidize early adopters. What tends to vary tremendously are the means of subsidy selected and the economic signals given by the subsidy.

The subsidy may occur across services within the same network. In the U.S. fixed telecoms sector, long distance calls were overcharged while local calls were subsidized to provide "universal service", namely no price discrimination for geographically isolated consumers. The subsidy may also occur through vertical relations within networks. In Europe, GSM telephone operators have been able to charge fixed networks high termination fees for fixed-to-mobile calls, while the regulated fixed networks have been powerless to retaliate. The money transfer resulting from high interconnection charges<sup>3</sup> has been partially passed onto consumers through handset subsidies. Network effects in mobile networks have resulted in large-scale substitution of fixed calls by mobile.

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<sup>3</sup> About €19 billion for the UK, France and Germany between 1998 and 2002. BOMSEL, CAVE, LE BLANC, NEUMANN, 2003.

In many cases, cross-subsidies occur along the content vertical distribution chain. Piracy or copyright circumvention can be a form of cross-subsidy: the utility of the distribution industry increases thanks to the availability of free content. YU (2003) and VARIAN (2004) both refer to the history of U.S. copyright law in the 19th century. After independence, newspapers and books were massively imported. In each state, local newspapers lobbied for a copyright law. The first federal Copyright Act voted in 1790 was limited to works by U.S. citizens. Between 1800 and 1860, the publishing industry expanded thanks to royalty free (and already market-tested) English books. Along the same lines, the U.S. refused a bilateral treaty on copyright proposed by England in 1842. By 1880, however, as American authors (Hawthorne, Irving, Poe, Beecher-Stove, Twain, etc.) began to gain popularity, editors started to complain about unfair competition with from pirated foreign authors whose books could be sold more cheaply. As a result, the Congress voted in the International Copyright Act in 1891 that expanded copyright provisions to foreign authors.

This short story shows how industrial conflicts can surge in the enforcement of copyright protection: vertical cross-subsidies from content circumvention play a major role in the roll-out of distribution systems. The innovative nature of digital distribution is twofold. Firstly, while in physical distribution, the costs of logistics are fully supported by the retail network, in digital systems, the consumer has to invest in terminal equipment to access content. Such equipment has to be rolled-out in huge mass consumption markets showing network effects. Secondly, "private" copyright protection measures have to be rolled-out together with equipment and content, which means that TPM have to be adopted by all the vertical players. While vertical conflicts around TPM adoption have always arisen, their resolution is far more complex — and more crucial — when several systems involving many sets of firms compete together to capture network effects.

### ■ DRMs on dedicated content distribution systems

We use the term "dedicated" for content distribution systems like the physical retailing of CDs or DVDs, radio or television where terminal equipment does not provide any utility beyond content consumption. Network effects on these networks are mediated by contents. Moreover, the prior consent of content owners is required (PICKER, 2004). Whenever content owners choose a standard, whether encrypted or not, network

effects promote it, as this standard allows consumers to access a larger range of contents.

Digital dedicated distribution systems such as digital satellite or digital cable have benefited from the initial roll-out of the TV sets. The latter benefited from the "free-to-air" distribution model for audiovisual content. In other words, consumers accepted the need to buy TV sets because they offered access to free contents. The free-to-air model is based on the network effects associated with two-sided market platforms, through which the consumers of one side (the viewers) can be valued by the clients of the other (advertisers). As information goods, contents can easily be structured into two-sided information platforms, decreasing their utility for consumers with ads, but making it possible to broadcast them for free (ROCHET & TIROLE, 2004). The more viewers, the more advertisers, the more resources available for new content, etc. Once TV sets were in place, pay content services were rolled-out together with marginal additional equipment (set-top-boxes) subsidized by distributors. In such systems, content has always been in a position to monitor the network effects and therefore, to impose technical standards for delivery and protection on the vertical chain of distributors.

Such systems will benefit from more flexible DRMs in the future, to allow contents to circulate within an authorized home network. The rapport de force of contents and their interest in such a roll-out should favour a surge in suitable solutions.

## ■ DRMs on the internet

In the beginning no one knew what the internet would be used for. Yet every time the networks were boosted by additional capacity, application followed the roll-out, rather than preceding it. However, since its beginning, the internet has been driven by one-to-one communication applications. E-mail, web services, instant messaging, e-commerce and network gaming take advantage of the two-way communication potential of the network. Those applications generate direct network effects that pull the broadband rollout. Peer-to-peer (P2P) applications have emerged in this context as a way of sharing content, but also, and even predominantly, as a way of circumventing copyright. These applications offer new uses for broadband services and use circumvention as a roll-out subsidy (BOMSEL *et al*, 2004)



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On internet networks, content owners have less bargaining power to impose protection measures on their vertical partners. Firstly, indirect network effects mediated by content are no longer conditional to the prior consent of content owners. The huge range of contents available on P2P networks provide indirect network effects that benefit and subsidize the roll-out of broadband networks (Internet Service Providers) and to all broadband complementary equipment (PCs, microprocessors, modems, software, music and video players). Secondly, internet networks are not dedicated to content distribution: PCs are multipurpose pieces of equipment, for which content consumption is only one of a wide range of applications. Moreover, they are pulled by one-to-one communications that provide strong direct network effects.

Internet players consequently are under no obligation and stand to gain nothing from accelerating the pace of DRM roll-out. On the contrary, they have a vested interest in trying to impose their proprietary DRM standard, while benefitting from the wild compatibility of P2P formats like MP3 or DivX. These strategies have led to incompatibilities in DRMs between digital offers and mobile players that are slowing consumers' adoption of DRM-based online distribution. Moreover, they may incite consumers to circumvent DRM technologies or to use P2P networks. In this vicious circle, before the standards war is over, no equipment manufacturer can afford to launch a content players that does not accept circumvented MP3 files (Sony tried to launch a digital music player solely compatible with its DRMs files, but quickly gave-up this suicidal strategy).

The on-line digital music market illustrates the reasons behind and results of incompatible DRM systems. Four major players are trying to impose their proprietary DRM standard. Two of them, Sony and Apple, refuse to license their DRM technology to other digital music distributors and portable players' manufacturers. Their proprietary DRMs (Apple Fair Play and Sony Open Magic Gate) secure a complete music distribution system composed of an internet music store, a media player and mobile players. Real Networks and Microsoft are pursuing the opposite strategy, namely trying to attract as many music stores and portable players manufacturers as possible to their own DRM technology (WMA DRM and Helix). Helix is open and Microsoft sells very cheap licenses for its WMA. Given its large market share, Apple's proprietary strategy induces major incompatibility issues between on-line music stores and mobile players.

## ■ DRM system roll-out issues

### The P2P problem: innovation versus creation

Massive circumvention via P2P networks is the major obstacle to the roll-out of DRMs. "Copyright respectful" digital offers cannot compete with easily accessible free contents. While free-to-air models decrease the utility of the consumer with ads, P2P offers the same product as paying content, with greater choice and flexibility of use. In addition, because it increases the utility of devices, P2P kills incentives for equipment manufacturers to loyally secure their products. However, many voices have been raised in opposition to DRMs for the sake of P2P technologies. DRMs have been accused of impeding innovation in digital technologies and networks. While the argument of P2P and DRMs being technologically incompatible does not stand, it is disputable that the cross-subsidization of new distribution systems by free contents may end up benefitting creative industries in the long term. The reference often cited for this long-term benefit is the large VHS market opened up by VCRs. However to what extent can innovation be promoted at the expense of incentives to create?

The evolution of U.S. court decisions on copying technologies shows that, with digitization, a new line has been crossed. In the famous 1984 Betamax case, Universal Studios and Walt Disney accused Sony Corporation of infringing their copyrights. Arguing that individuals' use of VCR (Video Cassette Recorders) would seriously damage their revenues, especially from advertising, they wanted the production and importation of VCRs to be prohibited. In a narrow vote the Supreme Court ruled in favor of Sony, considering that "time shifting" (recording television broadcasts for later viewing) was fair use. Moreover, as VCRs were primarily used for that purpose, selling them was not considered to be copyright infringement, despite their potentially unauthorized uses. An interpretation of this judgment could be that the VCR technology's potential infringement on copyright was considered to be overridden by the overall benefits of innovation.

However, this logic changed with the judgement on the (secondary) liability of P2P software providers for copyright infringement. In 2001 and 2003, the U.S. courts found two centrally mediated P2P systems (Napster and Amster) liable, as they materially contributed to copyright infringement. European courts applied the same logic. This trend was clearly confirmed in the MGM versus Grokster case. In the beginning, the U.S. Court of Appeals

applied the Sony-Betamax guideline and found no secondary liability of the decentralized peer-to-peer software providers for their users' copyright infringement. The decision focused on the non-infringing uses of P2P networks (exchange of non copyrighted material) and on the lack of control of P2P vendors over infringing uses. In June 2005, however, the Supreme Court ruled that P2P software providers could be held liable for copyright infringements committed by their users if they actively encourage that infringement. Three criteria were then defined to judge such active inducement of infringing uses: the marketing of infringing uses, the lack of a technology to fight them and the place of infringement in the business model. This decision led to the closure of the Grokster company <sup>4</sup>.

### Compatibility issues

A second obstacle to the roll-out of DRMs is their incompatibility. This is intrinsically linked to the existence of P2P networks. Manufacturers would be more inclined to make DRMs compatible, if P2P networks did not already provide this service through circumvented compatible contents. Moreover, the incompatibility of DRMs incites consumers to seek circumvented contents on P2P networks. This vicious circle fully benefits equipment manufacturers.

The impact of the incompatibility of DRMs on consumers is not unanimously considered negative, as it may result in a price decrease: if there are no network effects, incompatible vertically integrated systems face more elastic demand than compatible components (MATUTES & REGIBEAU, 1988). However, consumer surplus may not be superior to cases where systems are compatible. Indeed, compatibility increases variety, enabling consumers to mix and match (MATUTES & REGIBEAU, 1988). However, in the case of incompatibility, consumers remain free to accept or refuse each distributor's offer. This rule mostly applies to dedicated networks similar to broadcasting.

The rule applies as long as the consumer can chose between different integrated systems. In the second stage of a dynamic game, incompatibility may indeed lessen competition and prices may rise as one system may win

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<sup>4</sup> In Europe, the last decision on decentralized P2P software liability found no liability. The 2002 *BUMA vs. KaZaa* case, Amsterdam Court of Appeals, later affirmed by Dutch Supreme Court, considered that the KaZaa software was not used for "exclusively" infringing purposes.

the market (KATZ & SHAPIRO, 1994). This monopolization depends on the existence and strength of network effects. In the case of incompatible systems offering contents over the internet (as in the case of on-line music), network effects are mainly mediated by contents. They depend on the differentiation level of the content offering and on the range of contents that each system may provide. If one platform monopolizes all the on-line offerings of digital contents, the range of content variety accessible through digital distribution may be endangered. Another possible scenario, once the standards war is won, is that a DRM standard may start to be licensed as a monopoly in the vertical chain. However, this monopolization may not happen as every system benefits from strong indirect network effects provided by... compatible circumvented contents.

### **Moral hazard in content distribution**

As equipment and software manufacturers are the only beneficiaries of ineffective DRMs, it can be assumed that incompatibility is a source of "moral hazard" in digital content distribution<sup>5</sup>. Moral hazard means that these distributors are not doing their best to maximize the returns of their principals. Such moral hazard distorts the competition with distribution systems that protect copyright, gives out wrong signals to the market and misorients investment.

In broadcast networks, the contents monitor the utility of the system. In this case, there is little moral hazard attached to content protection within the system itself. The hazard may come from new digital recording equipment able to store contents in an open format through the analogue hole, and from the competition with open architecture systems that promote the diffusion of P2P files. This competition is forcing broadcasters into a race to roll-out DRMs due to a rise in content utility. This is why the launch of HDTV in Europe will be aimed at stuffing the analogue hole and enforcing consumers to record images in encrypted formats. Another example is the subsidization of set-top-box DVRs to promote the content recording through adapted DRMs.

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<sup>5</sup> Moral hazard occurs in a vertical relation where one party pursues its private interests at the other's expense. One example of moral hazard is drivers that behave carelessly when they know that the insurance company will pay for all of the damages. Moral hazard may deter players from engaging in mutually beneficial transactions. It reduces welfare by blocking such efficient vertical transactions. Moral hazard is also a source of market failure.

The consequences of moral hazard in internet-based content distribution are more serious for content that has no alternative digital distribution channel. Video content is massively distributed through digital broadcast systems, so it can withstand (even unfair) competition with broadband. However, digital music depends heavily upon the internet<sup>6</sup>. This is why the compatibility of music DRMs is such a controversial issue.

## ■ Conclusion

The paradox is that imposing DRM interoperability to protect copyright for cultural goods somehow calls into question the copyright of individual DRMs. Existing reverse engineering provisions for compatibility do not apply to DRMs: complex reverse engineering processes could not follow the fast pace of renewals of these security tools. Mandatory licensing, mandatory disclosure of DRMs interoperability information and public standardization are the different solutions available to public authorities willing to impose interoperability on DRMs. Critical issues are then the choice of the players that will support the costs of interoperability and the effective security of interoperable DRMs. The problem can be seen as the internalization of the negative externalities of incompatibility. The general principle in such cases is that the beneficiaries of the moral hazard pay the costs of interoperability. However, the lack of interoperability is not the only source of moral hazard. Interoperability will not be enough to ensure that copyright is respected or to achieve fair competition between content distributors. The solution should also imply the containment of illegal P2P networks and the implementation, probably at the hardware level, of efficient DRM protection able to discriminate between copyrighted and non copyrighted content. This is the only way to restore the content monitoring of indirect network effects in open communication systems.

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<sup>6</sup> Mobile telephony is indeed an alternative, but fixed broadband networks are far more convenient.

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