An Overview of Digital Rights Management in Digital Media

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So, What is Digital Rights Management?

Digital Rights Management, aka DRM, is a set of access control techniques for restricting the use of copyrighted works and proprietary hardware.

It is used to try to control the use and distribution of works such as music, videos, software, and hardware.

It is most commonly seen used for music, e-books, videogames, software and online videos.

This paper will focus on its use in digital media, namely in music and videogames. The aim is to look at its history, current use, shortcomings and alternatives.

A Simple History of DRM

The first published example of DRM comes via a paper submitted to the First USENIX Workshop on Electronic Commerce, from where it was published as part of the Proceedings of the First USENIX Workshop on Electronic Commerce.

It is a paper by three authors from Electronic Publishing Resources, where they discuss the need for a "cryptographically protected container for packaging information and controls that enforce information rights." [1]

Called DigiBox, the paper outlines the basic workflow of DRM that is still used till date.

Namely, that

- The customer buys the digital commodity.
- The customer tries to use said commodity
- The software checks with a server to see if the license is valid
- Once approved, the commodity is useable

The next notable milestone for DRM was when Mark Stefik, a researcher working at Xerox's Palo Alto Research Center, published an essay in 1997 discussing the possible implementations of DRM. [2]

The work of those at the Palo Alto center resulted in ContentGuard, a technology that was soon after licensed by IBM, as part of their efforts to become a provider of backend services. Their attempts to use it failed, however, due to slower speeds and smaller network of computers at the time.

In 1998, the Secure Digital Music Initiative was founded by over 150 companies, with the idea of creating a DRM system for use with music. The idea was that the encrypted music would only be playable on SDMI players. The technology was spearheaded by two companies, Microsoft and InterTrust, and aimed to tackle the issue of online piracy which arose with the development of the MP3 format. [3]

While the efforts of SDMI failed to create a universal standard, they did create the framework for Secure Digital card, a piece of technology still used extensively today.

From this point onwards, there are several examples of DRM technologies being developed, and many legal battles fought over patent infringement and misuse of DRM by companies.

Seeing as how DRM is made for many forms of media, the following is a short history of prominent points for DRM in music and video games. The focus is on these two mediums, as the methods used for them more or less encompass the majority of DRM used for digital media.

DRM in Music

The music industry was big, and with the creation of digital formats for sharing music, the popularity of music increase exponentially.

Of course, this also resulted in many issues with distribution and sharing of music, and many incidents of note.

Possibly most famous among these cases is Napster.

Founded by Shawn Fanning and Sean Parker, Napster was (in the context of its history, it has since been revived) a peer-to-peer MP3 sharing service, established in 1999. It popularized the use of MP3, a format for music which allowed sharing it digitally, and the concept of file sharing.
It allowed for easy cataloguing and sharing of music, leading to a massive boom in the usage of its services. (80 million registered users at its peak) [4]

This also led to a massive boom in piracy of music. The issue was that Napster did not restrict the uploading of music; anyone could put up any music, and anyone could download it.
This of course caught the ire many large record companies, not limited to Sony, Warner Bros. and the like. As a result Napster faced several lawsuits, eventually forcing the company to shut down. (Revival notwithstanding)
Following the fall of Napster, several music services cropped up to try and take its place, including services by the larger companies themselves.
Unfortunately, the people had become used to the free selection of Napster, and these new services were too expensive, and lacking in selection.

During this time, music was typically sold via Compact Disks (CD). These disks would often simply have the MP3 files on the disk without any protection measures; this of course changed due to the issues with piracy and Napster.

However, there were issues with early implementation of DRM. One incident of note would be the Sony BMG Rootkit Scandal.
The issue arose in 2005, when researcher Mark Russinovich noticed that a rootkit had been installed on his computer (allowing unauthorized access to his computer). [5]
He traced the software to a CD by Sony, and realized the issue. The DRM implemented by Sony worked by modifying the operating system of the computer itself, and interfered with the ability to copy files from the CD. On top of this, they caused vulnerabilities in the system, and even infringed on the copyright of other software.

The end result was a recall of many of the CDs, the removal of the software from future CDs, and a class action lawsuit against Sony (which they subsequently lost). [6]

While there have been other scandals and issues with piracy in the music industry, these two incidents were arguably the most notable.

Currently, the tactic against music piracy is not to prevent users from pirating music. Rather, it is to provide a service even more convenient than piracy.

Services such as Spotify, Apple Music and others offer a central platform of music, with a massive range of music for a simple subscription fee. The idea being that rather than download music via unverified services, and force people to go through various hoops to acquire music legally, a simple platform with a large range and simple fee is more attractive.

A tactic which seems to be working. Based on the results of a survey conducted by YouGov in Britain, music piracy is falling drastically as more and more people move to these streaming services. [7]

DRM in Videogames

As far as video games are concerned, there are two markets to consider. The console and the computer.

First, a brief history of DRM in consoles.

From their inception, most consoles have used the cartridge form of storage. Essentially a chip in a nicely shaped piece of plastic that plugs into a device meant to accept that specific type of chip, i.e. a video game console. This console would then be connected to a television and controllers, and people could play.

Early consoles had little to no DRM. That is in a way due to the nature of the cartridge. As it held all the data of the game, it was impossible to play a game without the cartridge, ergo one copy of the game per cartridge. While this did nothing against people borrowing, trading and selling cartridges, it did limit the ability to pirate games.

As game consoles moved onto CD-ROMs (a CD which could not be rewritten), however, issues of copying games arose.

This was limited again, in part, by the very hardware of consoles. As each console was built exclusively for video games, games developed for a specific console would need a specific form of low lever programming instructions, that is to say that a game made for console type A could not run on console type B.

This of course did not stop piracy between similar console types, which is where a few DRM measures came into play.

Most notable of these measures was region locking. This method would allow certain games, bought in a certain country, to only be played on consoles bought in the same country. This was achieved via a few methods, such as authentication between hardware/software, differences in cartridge and console connectors, differences in hardware and the like. [8]

Once again, this was a 'softer' method of DRM, as it does not prevent the exchange of CDs and cartridges among those in similar regions.

Of note is the fact that region locking has gone fairly out of use, only Nintendo currently uses it.

In addition to region locking, consoles often had online checks against hardware tampering and games often had checks against software tampering. As a result, piracy was fairly difficult for older consoles, even those that used CD-ROMs.

Computer games, i.e. PC games on the other hand have a more varied history with DRM. (PC being an important distinction in fact, as these would be video games for general, personal use)

Setting aside early games, there have been many interesting methods of both DRM, and punishing pirates.

Some of these methods (and the associated games) are: [9]

- Gradual Pixilation of the Entire Game (The Sims 4)
- Having Your Released Video Games Pirated (Game Dev Tycoon)
- Removing the Game Functions (Mirror's Edge Catalyst)
- Having Different Pentagrams in Game Manuals for Verification (Zack Mkraken)
- Including a Code Wheel with the Game (The Secret of Monkey Island)

Of course, these are the more light hearted and creative ways.

The more serious methods originated with the very first PC game, Microsoft Adventure. It used an early form of DRM created for use with floppy disks, in which the floppy disks would be written in a specific manner, so as to create bad sectors, differing track layouts and such within the very storage medium. [10]

This method was fairly unreliable however, due to the relatively volatile nature of floppy disks.

As a result, a new method soon emerged, one which is still used widely. This would be the passphrase. This could be as simple having a slip of paper with a specific alphanumeric code in the game box, or it could have you enter a specific word from the game's manual, or even code sheets made from photocopy-resistant materials. (This was still in the 90's – 2000's, sharing of images and copies of manuals wasn't as prevalent then)

That said these could still be bypassed given time and improved technology.

More methods came into the picture, including methods such as having fake files to fool CD burning software but these were once again bypassed as software improved.

Nowadays, the most common method of DRM is via third-party systems. Early third-party systems would use a digital signature during the burning of the legitimate copy of the game, and the software would check for the same upon installation.

Soon online distribution of games entered the scene, with distributors such Games for Windows Live, Battlenet, and most notably, Steam. This, alongside third-party DRM are the primary methods used for DRM in PC games today.

The services a unique game key with an online account, and thus a user has to log in to the account in order to play a game. As a result, even if someone acquired the game disk from somebody else, they would be unable to play it without purchasing a unique key.

Issues of course include the fact that a user without an internet connection would be unable to play, and even though services like Steam offer offline modes, they require an internet connection in order for verification initially.

There is also a widely hated variant of the online method, the always-online method. This requires a constant internet connection, and if the connection is even interrupted, or the verification servers are offline, the user is unable to play.

Less used but fairly infamous are limited use installations, where the game uses the hardware ID of computer components and registers them with an online server, and if the game is reinstalled on a different machine, one 'use' of the game is taken. These systems can be fairly forgiving, tying their use to the motherboard's device ID, or may require the entire system to remain the same.

While most DRM is accepted, albeit grudgingly, there is one highly infamous company/technology. Denuvo is a form of DRM which is licensed by a game developer, and integrated into the very code of the game. It is also arguably the toughest anti-piracy technology to break, surpassed only by always-online protection. (Which makes most games functionally uncrack able)

The main issue with Denuvo is the fact that it tends to hamper the performance of the video game, which is a large issue, considering that PC hardware can be highly varied, and as a result many people who have paid for legal, legitimate copies of the game suffer as a result. [11]
The irony of course being, that those who pirate the game gain increased performance and reduction in issues due to the disabling of Denuvo.

Of note is the mindset of modern DRM for video games. The idea of the DRM is not to prevent piracy. Rather, it is to give the publisher as large a window as possible upon release for sales, before the game is inevitably cracked.
That said, the current record for cracking Denuvo is less than a day, and the average time for cracking it is dropping. [12]

Shortcomings of DRM

While a number of these shortcomings have been mentioned already, they will be mentioned here again for convenience, if not expanded upon.

The first issue is of course reliability. As many forms of DRM tend to either require an online server for verification, or a physical component, legitimate users being locked out of their media can be an issue. Servers can go offline, and components can be damaged. To an extent this can also be extended for things such CDs, as DRM enabled CDs may not be compatible with different devices (say a console CD not working with a computer).

The second is of performance. This was covered when speaking about video games, as software such as Denuvo has been widely reported to cause issues in the running of the game, or caused noticeable drops in performance.

The final main issue is a legal one. In the eyes of the Terms of Service/License Agreement of most companies, when a consumer buys a DRM enabled product, they do not buy the product, but rather a license to use the product. That is to say that you do not buy a copy of a song, you buy the ability to listen to it.
An infamous example of this would be when Amazon very ironically remotely deleted copies of '1984' and 'Animal Farm' by George Orwell from the devices of Kindle users. [13]

This has also raised issues with accounts on services such as Steam, where if you die, you cannot leave your account as an inheritance. [14]
While the idea of leaving a video game account as inheritance may seem absurd, it is important to note that it could be compared to something akin to a collection of books. Many users may have spent several thousands of dollars (currency used due to its ubiquity) on their accounts, making them genuinely valuable.

Alternatives and Opposition to DRM

Due to the issues mentioned above among others, both groups opposing DRM and those encouraging alternative have arisen.
Of note in terms of opposition are public licenses such as the GNU General Public License. Public licenses such as GNU GPL 3 have been created with the aim of licensing software in such a manner that the software, and any derivatives, must be distributed freely and can be modified or shared freely. A notable example of a publicly licensed piece of software would be the Python

programming language, which is currently one of the most widely used high level programming languages.

Another form of opposition to DRM is the releasing of DRM free works. A notable distributor of DRM free work is GOG, a video game distributor which sells DRM free copies of video games.

That said, it cannot be denied that freely giving away music and letting people freely share software can have financial implications for an organization or individual. As a result, a few alternatives have been put forward to DRM.

The first is of course services similar to Spotify, wherein you have a large selection of music available for a relatively small fee. Alternatively, websites such as Humble Bundle and Itch.io allow consumers to pay as much as they want for video games (with possibly a minimum amount) with the goal of supporting smaller developers or giving to charities.

Another method is via crowdfunding, as the game will only be developed once a certain goal of money is passed. The advantage of this method is that the developers will reach a certain number of assured sales, and thus the issue of finances is reduced.

The Future of DRM in Digital Media

Frankly, the future of DRM could go a few ways. The primary issues with DRM pertain to its intrusiveness, in terms of loss of quality of the product, and the added difficulty of usage.

There is already a strong anti-DRM sentiment amongst the gaming community, and for music and video the availability of streaming services and high-speed internet mean that most consumer no longer buy individual products.

Should companies attempt to be more aggressive with DRM, it would likely result in a revolt of sorts amongst consumers, and would likely lead to a crash in product purchases.

Should companies remove it entirely, there exists a danger of piracy stripping a company of meaningful sales.

The ideal method would seem to be to offer competitive services to piracy, ala Spotify and Netflix, and make it so that the legal route is both affordable and convenient for consumers

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