DRM Trends and Development
An Ongoing Affair

10 YEARS OF CONVERGENCE
1998 - 2008

SKMM
MCMC

Suruhanjaya Komunikasi dan Multimedia Malaysia
Malaysian Communications and Multimedia Commission

CONTENT

FOREWORD

On behalf of the Malaysian Communications and Multimedia Commission (SKMM), it is my pleasure to present to our readers the report on *"Digital Right Management (DRM) Trends and Development – An Ongoing Affair"*.

The report features the basics of Digital Rights Management (DRM) and its growing importance in an increasingly digitised communications services environment that is indeed showing nascent convergence. There is a discussion on the reasons why DRM is needed as it relates to piracy and the necessity for content protection and control in a changing digital media content production and distribution landscape. The process of DRM versus conditional access is discussed, as well as the extensions to DRM development in digital watermarking and finger printing. Such market developments are driven by necessity for new business models and monetisation of content or digital assets. This is especially so in the digital era where the Internet and indeed such services offered through broadband access gains higher prominence and in seemingly more fragmented market segments as social networks increase; user generated content and Peer-to-Peer (P2P) file sharing become commonplace.

A study of the DRM working groups worldwide indicates the increasing desire for DRM systems to be simple for all stakeholders - one of such aspects is the call for interoperable DRM systems. Alternative business models to complement DRM systems are also discussed, citing the need for appropriate models used in context as it pertains to the consideration of a balance of cost as to benefits of use to all parties concerned.

There is also a brief look at copyright and its developing legal framework; the implementation of changes and resulting implications in the digital arena where DRM is used; including the balance sought by consumer movement. Furthermore, the implementation challenges and issues in DRM systems and their usage are discussed.

A soft copy of this report can be obtained from the SKMM website at:

http://www.skmm.gov.my/what_we_do/Research/industry_studies.asp

I trust this report will provide useful information to readers and indeed can serve as a catalyst to constructive business ideas and perspectives that can propel the communications and multimedia industry development.

SKMM welcomes any comments and feedback that will help us improve this report in the future. Please send your comments to webmaster@skmm.gov.my

Thank you.

Datuk Dr. Halim Shafie
Chairman
Malaysian Communications and Multimedia Commission (SKMM)

EXECUTIVE SUMMARY

In a new converging environment, diverse content reaches a greater number of users who can access these through online distribution such as mobile wireless communications, Internet and interactive TV networks. Content in digitised formats, perfect duplicates risk rampant piracy. Hence, there are various ways to the management of copyright in the digital content media through the use of measures such as conditional access and digital rights management.

DRM can function not only to allow electronic content control through technology used to enforce licence agreements between customers and service providers, but also manage access to content through a system combining technological measures, payment mechanisms, customer management, and authorisation schemes. This is done by enabling service providers to keep track of individual downloads, for example, the number of times a music or a video is used to embedded information on content for audit trail in infringing uses. DRM is fast attracting market usage that is today capturing millions of revenue in US dollar worldwide and as industry expects, into the future.

DRM is influencing digital content management in various platforms, traditional and new such as cable and satellite, and more recently, Internet Protocol Television (IPTV). While DRM is a more recent development, the Conditional Access (CA) technology market still stands as a strong copyright and distribution protection mechanism for IPTV and cable due to its earlier deployment and over existing infrastructure for addressable markets. DRM deployment is seen oriented to the newer broadband and mobile music, games and video market segments.

In reality, while DRM solutions do solve problems for content owners and distributors, there are some so-called "side-effects" such as non-universal access to play a DRM-enabled Compact Disc (CD) on any computer or car CD player.

According to Multimedia Intelligence (MMI), market forces in DRM based business models are the primary drivers of DRM to expand beyond its conventional methods of protection mechanisms. In this respect, fingerprinting and digital watermarking are emerging enhancements of present DRM and serve the purpose of creating evidence of copyright or its overall use to counter illegal attempts to either reproduce or manipulate content. Coupled with lower cost factor, such extensions are needed in the proliferating User Generated Content (UGC) and social networks including P2P file sharing media environment. While such technologies are at a relatively early stage of development, it is forecast to generate incremental revenue from 15% to 30% through 2012 to USD93 million from USD20 million currently. The DRM and technology vendors are listed here based on their approach as "conventional DRM" vendors or in terms of "digital watermarking and finger printing".

There is expected not only revenue from software and services revenue, but also revenue from use of the Intellectual Property Rights (IPR) of these control measures. Such protection system is still evolving in response to the landscape changes and challenges faced by all stakeholders concerned. Needless to say, "no matter how innovative a technology can get, there are surely culprits who get even more innovative". This is said as despite having digital rights management in place, there are various and evolving forms of piracy to tackle, for example, Compact Disc-Recordable (CD-R)/ Digital Video Recorder (DVR) piracy, pressed CD piracy, Internet piracy and other new forms of digital piracy such as Local Area Network (LAN) File Sharing, Digital Stream Ripping and Mobile Piracy.

It is noteworthy that DRM technology is not a piece of software. It is a combination of several technologies and services, which include identifiers, metadata, rights languages, encryption, and technologies for establishing the link between content and metadata, that is, persistent association technologies, and those related to ensure privacy and secure payment.

The digital media ecosystem is said to be an evolving one. It is an ecosystem that encompasses a "digital environment" containing elements such as content type, business model, content source, distribution and technology – all constantly in a state of flux in advancement, rejuvenation, and change. Overall, considerations are in the areas of accommodating security, economic benefits, customer-relations and legal reasons to all parties in the DRM value chain. There is an increasing trend towards the development of interoperability between devices and services to meet consumer demands. As such, there are significant DRM Working Groups in such movement and focus to facilitate this for mutual benefits among its members, including the focus towards interoperability in DRM systems as a high priority.

As is the case with any emergent technology, the implementation of DRM is likely to face significant challenges as well. No doubt DRM systems face challenges in securing revenue or monetising content. However, there is a need to ensure that DRM systems are used within appropriate context after weighing the cost and benefits of implementation. DRM usage should also be weighed amongst alternative business models to ensure such "appropriate usage".

Copyright has historical roots and debates that go way back in time. Now, the era of digitisation has all stakeholders re-looking "copyright" through the digital lens, so to speak. In the context of DRM, the issue of and debate on copyright are no less intense – this is from the perspectives of the stakeholders such as copyright owners, content aggregators and distributors, legal fraternity, policy makers, consumer associations and consumers. Joint dialogue is important to sort out the legal, economic, social and technical issues in DRM and copyright in a world that is increasingly going digital. The industry also calls for transparency in the debate, that is, of who does what and with which outcome, thus offering opportunities for joint dialogue beneficial for enhancing thinking and debate.

The digitisation of all types of content has prompted the call from stakeholders to ensure copyright and the use of DRM, including provisions against circumvention, is properly instituted in the legal framework. Hence, the World Intellectual Property Organisation (WIPO) Treaties in 1996, that establishes common and basic legal norms for protection of technical measures used such as DRM. There are also cases for exceptions to copyright for user groups/ purposes such as visually impaired, education purposes, and public reporting circumstances. Again, the digital scenario offers new forms of interpretations that need to be viewed or reviewed in context.

As with any technology that is implemented, each of them has their own strength and weaknesses. In the case of DRM and its implementation, all actions in terms of rights management need to satisfy parties involved from the end user to the rights holders. Since digital data security is not confined to the computer which holds the data or even behind firewalls, DRM is likely to face significant challenges of not only encrypting data but also to define control mechanism to control actions of how users use the data. Some of the challenges in DRM implementations include the ways of managing, tracking and enforcing usage rules; manage the trust relationship between DRM agents and media applications/ decoders owners; and ability to use and take advantage of features to secure platform. In short, such applications need to be used in careful consideration.

DRM TRENDS AND DEVELOPMENT – AN ONGOING AFFAIR

Changing Digital Content Management Scene

To date, modern information technology has made it possible to reach a greater number of users. Not only do they navigate, but they also can search and utilise in many sorts of ways across diverse forms of content. The choices of online distribution may take place through mobile wireless communication, Internet and interactive TV networks in the nascent converging environment.

Within this context, the digital environment infuses the ubiquitous use of computers, consumer electronic devices and wireless/ mobile handsets into end-user platforms, with interactive media applications and of course, download services, in an increasingly simple, interoperable, and seamless manner.
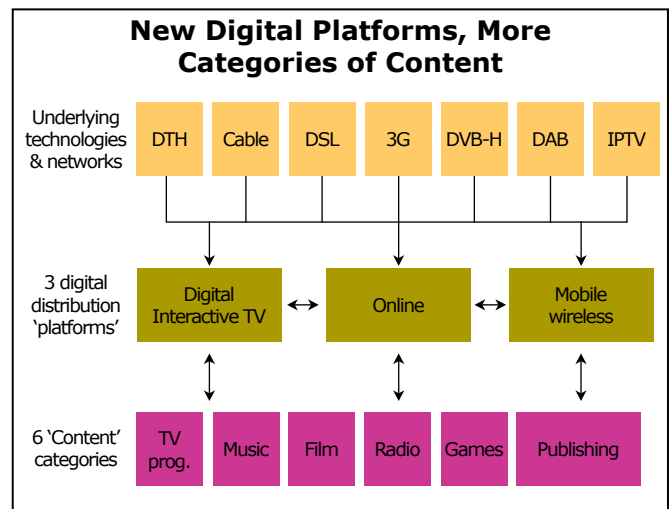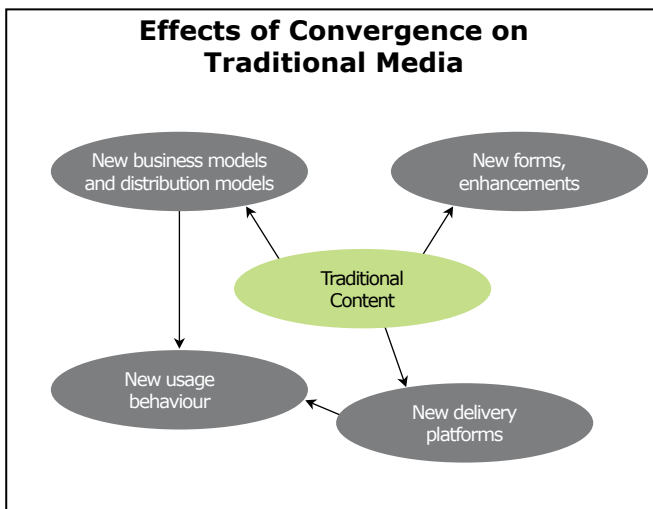
Effects of Convergence on Traditional Media

New Digital Platforms, More Categories of Content

Source: Adapted from "A Study for the European Commission (DG Information Society and Media)" by Screen Digest Ltd, CMS Hasche Sigle, Goldmedia Gmbh, Rightscom Ltd, Final Report, 2006

In this digital environment, traditional content through broadcast boundaries is blurred, with the entry of non-broadcast players such as software providers, Consumer Electronics (CE) manufacturers and network service providers (mobile and broadband access providers) into the content distribution/ services scene. With more service platforms for access to content, and the relative ease with which users can purchase one copy and then make many duplicate copies, the risk of misuse and abuse or simply, having copies made for sale in the lucrative black market increases.

As such, malicious intent hampers legitimate business ventures. Unlike analogue technologies, digital copies are perfect replications, that is, no loss of picture quality. This has far-reaching implications to copyright holders and content distributors.

Efforts to curb the problem of piracy in the increasingly digital world of media and communications services are through DRM introduced in the market in the

The Value Chain of Digital Content

Source: Adapted from "A Study for the European Commission (DG Information Society and Media)" by Screen Digest Ltd, CMS Hasche Sigle, Goldmedia Gmbh and Rightscom Ltd, Final Report, 2006

late 1990s. Although Conditional Access (CA) services have been around longer, the changing digital content management scene requires a further complement or broader concept of content control through DRM.

DRM not only allows electronic content control through content control technology used to enforce licence agreements between customers and service providers, but also manages access to content through a system

combining technological measures, payment mechanisms, customer management, and authorisation schemes[1]. This is done by enabling service providers to keep track of individual downloads, for example, the time listened to music or the times a video is watched to the use of embedded information on content for audit trail in infringing uses. DRM is fast attracting market usage that is today capturing millions of revenue in US dollar worldwide and into the future.

DRM Market Landscape

Global revenue forecast for DRM and CA applications by key interactive communications services business models are expected to trend upward as shown below:

DRM and CA Revenue by Interactive Business Models Worldwide (forecast)

Interactive Business Models (by Market Segment)	2006	2007	2008	2009	2010	2011	2012	CAGR 2006-2012 (%)
CA	USD (Million)							
IPTV	45	76	174	256	369	512	692	58
Cable	286	379	679	758	803	820	835	20
Satellite	560	655	938	964	953	923	900	8
Mobile TV	14	49	76	117	165	224	284	65
Satellite Radio	10	13	15	16	17	17	17	9
Total	**915**	**1,172**	**1,882**	**2,111**	**2,307**	**2,496**	**2,728**	**20**
DRM	USD (Million)							
IPTV	5	10	20	43	74	113	163	79
Cable	13	19	31	51	61	71	123	45
Satellite	11	13	17	24	34	43	106	46
Mobile Video	54	93	140	183	216	214	210	25
Broadband VoD	4	6	8	9	13	18	25	36
Broadband Music	54	62	69	74	78	81	82	7
Mobile Music	416	501	597	683	794	864	917	14
Mobile Games	141	180	226	273	348	416	457	22
Total	**698**	**884**	**1,108**	**1,340**	**1,618**	**1,820**	**2,083**	**20**
DRM/CA	USD (Million)							
Walled Garden VoD	17	27	36	53	81	112	149	44
Broadband Games	27	47	51	82	134	188	236	44
Total	**44**	**74**	**87**	**135**	**215**	**300**	**385**	**44**

Source: Adapted from "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by Multimedia Intelligence (MMI), 2008

DRM is influencing digital content management of many services provider in various platforms, traditional and new such as cable and satellite, and more recently, Internet Protocol TV (IPTV). While DRM is a more recent technology development, the CA technology market still stands as a strong copyright and distribution protection mechanism for IPTV and cable (as indicated from the forecasts in the table), with CA revenue expectation from these markets growing more strongly compared to DRM usage. The major reason is that CA predominantly catering to the established cable markets worldwide has a head start in terms of servicing size of this existing market, and also well-deployed infrastructure. CA in IPTV is also expected to gain ground relatively quickly due to its orientation to the addressable video market and aligned with early adopter consumers[2]. This is the same for CA in the satellite market segment.

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[1] "Study on the Implementation and Effect in Member States' Laws of Directive 2001/29/EC on the Harmonisation of Copyright and Related Rights in the Information Society" by Institute for Information Law, University of Amsterdam, February 2007
[2] "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008

DRM deployment is seen oriented to the newer mobile music, games and potential mobile video market segments. DRM is expected to feature as the technology for digital content management in the newer services offered through the broadband medium as well through to 2012. For example, media companies have started to choose protection mechanisms for Video on Demand (VoD) content in the Walled Garden and Broadband channels as their projected revenue stream indicates a positive growth for each segment from 2006 to 2012. Likewise, there is expected uptrend in DRM revenue from broadband music and games segments.

CONTRASTS OF CONTENT CONTROL MECHANISMS

Copyright

According to Oxford Dictionary, copyright is "the exclusive legal right, given to the originator or his or her assignee for fixed number of years, to print publish, perform, film or record literary, artistic or musical material, and to authorise others to do the same". Copyright is a means of controlled management of distribution or usage of content in a legal manner. That is, non-compliance can result in some form of penalty instituted by law. As such, content in a published form cannot be reproduced, published or copied without permission from the copyright holder. It is about who owns the right to a certain product or work. There are various ways to the management of copyright in the digital content media such as through the use of main measures of conditional access and digital rights management.

Digital Rights Management (DRM)

There are various definitions of DRM from analysts, stakeholders and regulatory jurisdictions. Effectively, DRM is understood as the management of secure exchange of digital content, or in more specific terms intellectual property, such as music, video or text and even medical or financial records across different digital channels. DRM not only permits content users to access authorised content, but also allows distributors to monitor the use of the content, including enforcing restrictions on its usage. In short, DRM is one of the content access control mechanisms also functioning as a method to monetise the use of digital content.

Some Definitions of DRM
• DRM is the secure exchange of intellectual property, such as copyright-protected music, video or text, in digital form over many different digital channels, or other electronic media. *Source: Capgemini Consulting*
• DRM is 'technology that protects content against unauthorised access, monitors the use of content, or enforces restrictions on what users can do with content'. *Source: Forrester Research*
• DRM "is really the umbrella terminology which encapsulates conditional access, content protection, Digital Watermarking (DWM) and fingerprinting as general content monetisation technologies". *Source: MultiMedia Intelligence*
• DRM refers to the technologies and/ or processes that are applied to digital content to describe and identify it and/or to define, apply and enforce usage rules in a secure manner. *Source: www.wipo.int*
• DRM means the chain of hardware and software services and technologies governing the authorised use of digital content, and management of any consequences of that use throughout the entire life cycle of the content. *Source: European Digital Media Association (EDiMA)*
• A technology protects the copyrights of multimedia by enabling secure distribution and/or disabling illegal distribution of the data and intended to give control over redistribution and access to material. *Source: International Telecommunication Union (ITU); WG3 working document*
• Seeks to prevent the unauthorised copying and redistribution of digital media in context of digital broadcast copy protection. *Source:- Federal Communications Commission; Copy Protection Technical Working Group (CPTWG)*

In a physical environment such as CD and DVD formats, a copyright law exists to control access and manage payment from the perspectives of distributorship and end user access. In the new digital age, conditional access, more specifically in broadcast platform, controls access through set-top boxes. To date, the proliferation of Internet usage for online music downloads and video streaming or mobile broadcast, the technological measures to control access and distribution are done increasingly through the service of DRM technology. The technology of DRM (and no doubt, conditional access as well) appears to be evolving over time to cater to the changing environments for content access and distribution.

There are a few common DRM technology solutions and their functions as illustrated below:

Common DRM Technology Solutions	How it Works
Copy, edit, save, print and/or share disabling	Prevents standards users from performing any of the actions listed where such actions would violate a copyright agreement.
File open limit	Limits the number of times a standards* document can be opened on a computer, effectively limiting access to file as outlined in a licensing agreement.
File time limit	Limits the amount of time a standards document can be opened on a computer, effectively limiting access to the file as permitted.
Portable Document File (PDF) lock down	In the case of single-user licences, PDF standards can be "locked down" to only open on the computer originally downloaded from.
Watermarking	Standards documents can be altered at the point of purchase to include a watermark indicating such information as identification of the original purchaser, download location, and licensing terms, all of which is retrievable from illegally copied or distributed versions.

*Refers to any forms of digital medium
Source: DRM - Mitigating the Risk of Copyright Infringement, IHS Whitepaper website

In reality, while DRM solutions do solve problems for content owners and distributors, there are some so-called "side-effects". A few cases are related below where the implementation of DRM systems is in DVD, CD or online services:

- Sony BMG released selected CDs with a DRM that restricts consumers to making only three copies of the CD. Another example of private copying restrictions are the terms of use for the music download service, Napster: *Consumers may burn each track they purchase only seven times as part of any particular play list of songs.*

- A consumer in France bought a CD distributed by EMI, one of major music publishers. At home, he discovered that he was not able to play the CD on the computer or in his car's CD player. As he learned later from a friend, this has to do with electronic copy protection technology, a so-called DRM system that EMI used on the CD.

- DVDs of the movie "Mr. & Mrs Smith" released in Germany contained the so-called "Alpha-DVD" DRM technology. Consumers trying to play the CD on their computer reported system crashes, malfunctions of their DVD burner - even when burning other DVDs as back-up copies, or even a complete crash of the DVD burner.

- In 2005, Sony-BMG released a new DRM technology (XCP) that would install, without the knowledge of consumers, software on their PCs to control and monitor the way they use Sony's music.

Source: Adapted from "Consumer's Guide to Digital Rights Management", www.indicare.org, 2006

Conditional Access

Conditional access is the protection mechanism used to ensure only authorised user or subscribers are able to receive the digital content subscribed. CA is applicable to all types of entertainment as well as literary works; even medical or financial records for purposes as follows:

- Control of content viewing or listening;
- User authentication; and
- User authorisation.

According to MMI Report 2008, among the leading conditional access companies are Cisco (Scientific Atlanta), Irdeto, Motorola, NDS, Nagra, Verimatrix, Viaccess and Widevine Technologies[3].

The contrasts between CA and DRM are as follows:

Conditional Access (CA)	Digital Rights Management (DRM)
Started 1980s	Started late 1990s
Usage mainly in broadcast environment such as television and set top boxes	Usage over networked environment such as online music downloads and VoD services
End user equipment limited to TV and set-top box	Diverse end-user equipment such as in a home network or mobile platform
Audio and visual only	All types of entertainment including games, software, hardware, home entertainment network.
Business models: subscription, pay-per-view	Business models: pay-per-view, record and view a number of times, record and view freely and view until specified period
Protects billions of dollars of revenues	Microsoft DRM in every PC
Exposed to piracy	Limited exposure to piracy, software and hardware security
Closed network for examples, cable, DTH and STB	Open network for examples, Internet and PC
Protects network and service delivery	Content Security is main objective for DRM creation
Limited storage capacity environment	Extensive storage capacity environment
Access is based on specific conditions associated with consumption of the content	Access is granted through a simple Yes/No system
System design tied to MPEG2-TS transport layer, i.e., CA client = software library embedded in the STB+ dedicated hardware (chip in the STB and or smart card)	System design tied to content coding format For example, one DRM for each content format.
Examples of CA systems are NDS Open VideoGuard, NagraVision's Nagra, Canal+Technologies' MediaGuard, Telenor Conax-CAS3, SkyStream's DVB, Microsoft's Access	Examples of DRM systems: Microsoft's Windows DRM, Apple's Fairplay DRM, Sony's Open MG

Source: Journal of Digital Asset Management, Digital Rights Management Final Report (2003), CEN website & Wireline and Wireless Digital Rights Management: Securing Content Distribution 2007~2012, The Insight Research Corporation, Viaccess

DRM OFFERINGS

Incentives for DRM offerings can be overall seen spurred by two aspects of changing media environment and the need to curb piracy. Piracy raises the risk of loss to vested parties as the digital media environment opens more windows of opportunity all around.

Changes in Media Environment

Digitisation - Changing Media, Communications and Commerce

As is obvious from the CA and DRM contrasts, the context of use and usages of CA and DRM differ accordingly. As advancing technologies facilitate or enhance existing traditional media, this and the new media offers or requires other supporting services such as rights management. In the increasingly digitised environment today, the right management services have taken on different and even more enhanced ways to manage digital content for purposes of content access control; measurement for purposes of control duplication; in addition to copyright management.

Physical distribution methods such as newspapers, CDs and DVDs are increasingly being complemented by digital equivalents in e-periodical, video file downloads through the Internet or video streaming through mobile devices. These not only facilitate e-commerce or online transactions, but also require simultaneous development in the supporting measures such as CA and DRM to manage controlled use of the digital content.

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[3] *"Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media"* by MMI, 2008

Such developments in parallel ensure that the cycle of economic production and use from the point of production/ manufacture to the consumption by the end-user revolves or evolves in a sustained business cycle. For example, the revenue generation for content owners and production houses in video business, and the ultimate satisfaction in use by the consumers – thus, create a dynamically successful economic exchange of goods and their consumption.

Distribution Trend – Physical to Digital
e-Commerce Transactions

Physical – facilitates sale of traditional media such as books, CDs and DVDs.	Digital – electronic form of content such as audio, video, written text and games.
This trend is supported by influence of the Internet on: 1. Transaction costs; 2. Costs of transport and marketing; 3. Progressive rollout of high bandwidth transmission networks; 4. Advances in content control technologies; and 5. Development of different methods of financing and charging for intangible content.	
For example, subscription models include: 1. Pay per download; 2. Pay per bundle; 3. Pay per use	

Source: Adapted from "Study on the Implementation and Effect in Member States' Laws of Directive 2001/29/EC on the Harmonisation of Copyright and Related Rights in the Information Society" by Institute for Information Law, University of Amsterdam, February 2007

Online Services

On-Demand Distribution
• New business model in forms of downloading and streaming, delivered pay per download or pay per package; also in free, ads financed services or subscription models.

IP-based Broadcasting
• Traditional business model (broadcasts distributed via terrestrial, cable & satellite) gone online

IP-based Publishing
• Traditional service that went online; new business models from availability of digital format

Downloading
- Viable for almost all content such as:
  • Audio (music, pod casts)
  • Video (movies, TV shows, video podcasts, music videos)
  • Games or text-based content (also IP-based publishing)

- Content delivered from providers servers to customer digital devices such as computer or DVR. An identifical copy is created that can be stored & accessed according to consumer preferences & needs, e.g., Bertelsmann's In2 movies download service at www. in2movies.de

- Can be permanent or rentals, i.e., movies watched within 5 to 7 days after downloaded also this way; most widespread business model across all types of content

Streaming
- Content is stored on distributors servers and can be delivered to users individually as they access it

- No permanent copy remains on the customers hardware

- Users can freely choose when to view, e.g., Sony BMG offers music videos and behind-the-scenes footage from their Musicox Video webside at www. sonybmg.com/musicbox/video

Webcasting
- Over Internet in webcasting or digital content streaming

- Webcasting access through:
  • Web browser
  • Client software, e.g., RealPlayer, Windows Media, Apple's iTunes
  • Radio station simulcast & Web only radio stations

- Wedcasting supplied by traditional broadcaster and non traditional providers such as directories and portals that act as content aggregators - Yahoo & Google; Telecoms operators; physical retailers & ISPs

- Webcasts mostly free of charge (ad-based, promotional or amateur content)

IPTV
- Over proprietary networks in IPTV offerings such as TV broadcasts, movies or radio

- Offered commercially now in Europe on monthly or yearly access fees; through packages such as triple play; or together with consumer electronics devices such as DVRs with broadband access

- pay-per-view mostly reserved for on-demand content such as major sports events or movies

e-Periodicals
Which is digital production and distribution of published works and catalogues capturing new potential readers; can be offered free of charge and are ads-based or promotional; e-newspapers can be offered on monthly or yearly pay basis; with options to ask for download payment for older articles in archives

Open access online journals e.g., scientific journals where institutions or individual experts pay a one-time fee to have their papers or journal articles made publicly available, e.g., Open Library of Science

Digital delivery services e.g., British Library sends documents or e-Books electronically to users with clearly defined usage rights & limitations,e.g., files viewed & printed, but not to sent to third party through e-mail. DRM systems possibly applied

Weblogs
- Blogs are websites that are regularly updated; usually centred on a specific topic or on the author; mostly text-based, but can be images, short video or audio clips

- Currently offered free of charge, but could be for micro-publishing such as ads-based financing, corporate sponsored blog or a section of a blod and premium segments & content , e.g.,in-depth newsletter on subscription basis

Sites for Social Networking
- User generated content
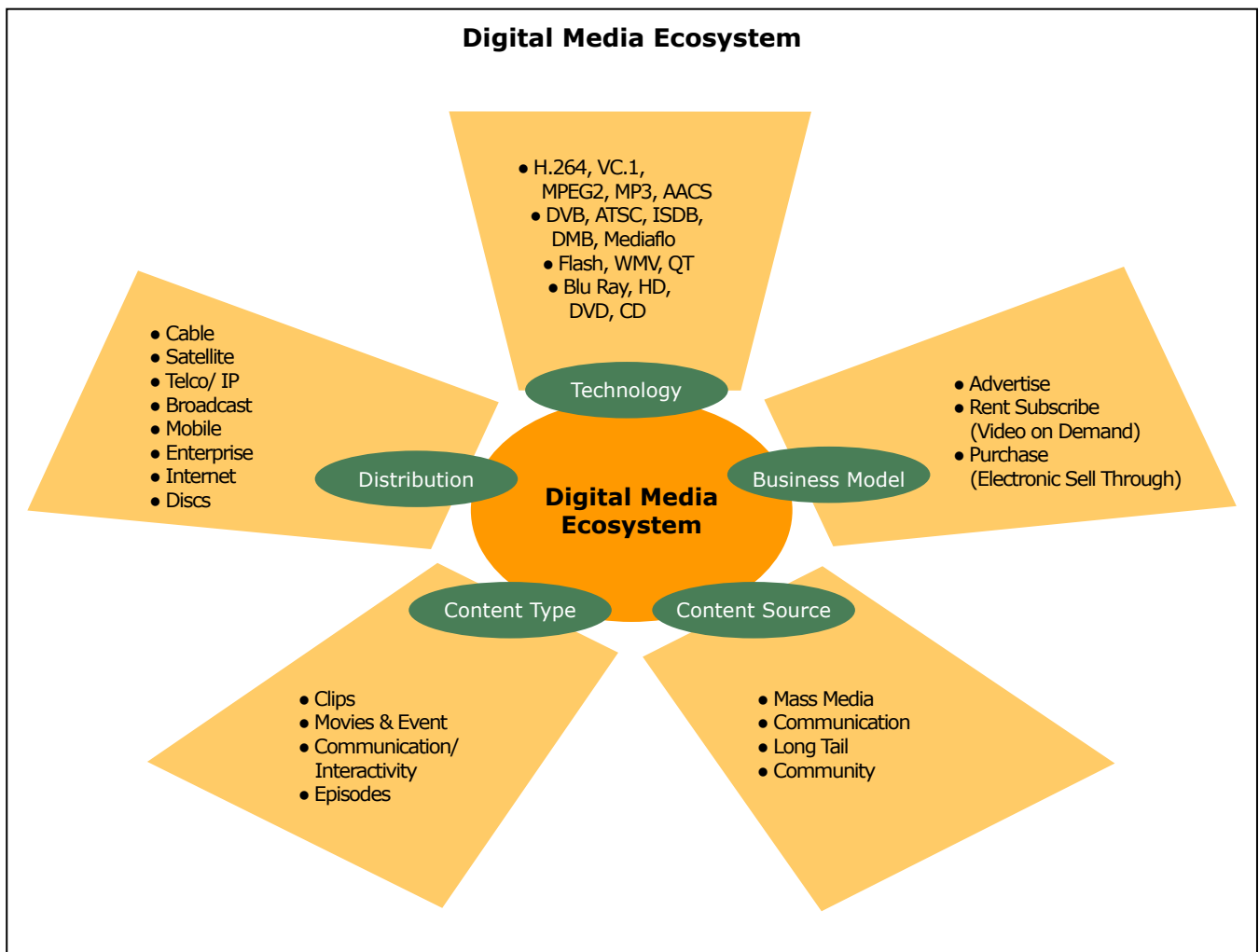- P2P file sharing (text or video)

Source: Adapted from "Study on the Implementation and Effect in Member States' Laws of Directive 2001/29/EC on the Harmonisation of Copyright and Related Rights in the Information Society" by Institute for Information Law, University of Amsterdam, February 2007

Digital Media Ecosystem

The digital media ecosystem is said to be an evolving one. It is an ecosystem that encompasses a "digital environment" containing elements such as content type, business model, content source, distribution and technology – all constantly in a state of flux in advancement, rejuvenation, and change. These elements facilitate the utilisation of proven technologies; the increasing trend towards the development of interoperability between devices and services to meet consumer demands; the sustainability and development of knowledge in the networked environment, and all this is done through increased innovation and differentiation.
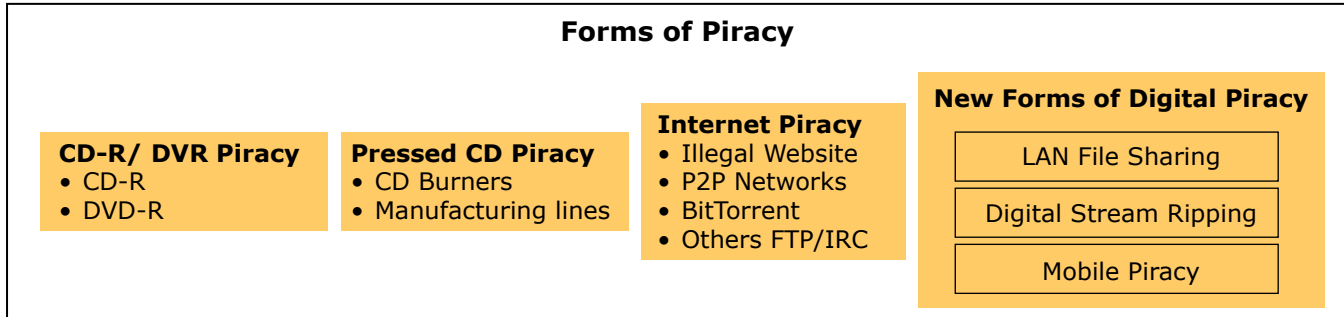
Digital Media Ecosystem

- H.264, VC.1, MPEG2, MP3, AACS
- DVB, ATSC, ISDB, DMB, Mediaflo
- Flash, WMV, QT
- Blu Ray, HD, DVD, CD

Technology

- Cable
- Satellite
- Telco/ IP
- Broadcast
- Mobile
- Enterprise
- Internet
- Discs

Distribution

Digital Media Ecosystem

Business Model

- Advertise
- Rent Subscribe (Video on Demand)
- Purchase (Electronic Sell Through)

Content Type

Content Source

- Clips
- Movies & Event
- Communication/ Interactivity
- Episodes

- Mass Media
- Communication
- Long Tail
- Community

Source: Adapted from "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008

Piracy

International Federation of the Phonographic Industry (IFPI) defines piracy as the deliberate infringement of copyright on a commercial scale. In the context of DRM, piracy can be taken to refer to a user who has illegitimate access to physical form, digital form as well as new forms of digital content which could lead to economic losses for parties such as the government, mobile service providers, Internet service providers as well as consumers.

Diversified Forms of Piracy

Piracy has diversified into various forms compared to when it started during the introduction stage of personal computers in 1970s. There are CD-R/ DVR Piracy, pressed CD Piracy, Internet Piracy and new forms of digital piracy which includes LAN File Sharing, Digital Stream Ripping and Mobile Piracy.

Forms of Piracy

CD-R/ DVR Piracy
- CD-R
- DVD-R

Pressed CD Piracy
- CD Burners
- Manufacturing lines

Internet Piracy
- Illegal Website
- P2P Networks
- BitTorrent
- Others FTP/IRC

New Forms of Digital Piracy
- LAN File Sharing
- Digital Stream Ripping
- Mobile Piracy

Source: Adapted from "The Recording Industry 2006 Piracy Report", www.ifpi.org, 2006

Piracy tends to fall into two intertwined categories which are physical and digital. Physical piracy is the illegal manufacture and distribution of copyrighted material usually in optical disc formats (mainly DVD-R and CD-R). This can take place professionally, by large-scale criminal outfits, or casually, by the consumer copying a legally purchased disc for friends or relatives.

Digital piracy or online piracy is the illegal copying and dissemination of copyright music or video *'virtually'* over digital platforms - over Internet through LAN file sharing, digital stream ripping and mobile. To date, consumers and casual copiers do make music collections online through P2P file-sharing services, but the digital channel can also provide a route for more professional physical piracy enterprises to transmit illegally copied files. According to the IFPI, trade of pirated disc or physical piracy was worth USD4.5 billion globally in 2005. Almost 20 billion tracks were illegally swapped or downloaded on the Internet in 2005.

Factors Driving Internet Piracy	
Factors	**Means and Advantages**
Digitisation	Means: The conversion of analogue signal/frequency into a stream of numbers. Advantages: • Compression which smaller file size and less transmission time; • Low Distortion, i.e., copy as good as original and each copy is perfect source for further copies; and • Storage Media in terms of no media constraint; different types of Internet protocol stored in same media.
Bandwidth	Means: Bit rate of the system. Advantages: Users able to send large files in short intervals.
Web Sites	Means: Web Servers. Advantages: • Users can easily be publishers of IP works with worldwide connections; and • Users can easily be aware of pirated works, even they did not intend to find them.
File Sharing Technology	Means: • The Client server Model; • File Transfer Protocol Server; and • The Peer-to-Peer Model. Advantages: • High anonymities; • High availability of IP works; and • Short downloading time.

Source: Adapted from "Internet Peer-to-Peer Piracy and Forensics", www.chinaitlaw.org.hk, February 2007

Channels for Internet Piracy	
File Transfer Protocol (FTP)/ Website	Enables uploading and downloading of pirated copyright works to and from FTP server.
E-mail with Attachment	Pirated works are attached in the e-mails for distribution.
Auction Sites	Enables posting of pirated works for auction.
Peer-to-Peer Networks	Each peer is a client as well as a server in the distribution of pirated works.

Source: Adapted from "Internet Peer-to-Peer Piracy and Forensics", www.chinaitlaw.org.hk, February 2007

Losses to Piracy - Music Industry

IFPI analysis shows that music piracy in a total of 31 countries exceeds 50% level. It appears that countries with piracy level less than 10% mostly comprise those among the developed nations. This could be due to better control, relatively more enforcement factors and ethically discerning users.

Impact of Piracy on US Recorded Music	
Job lost	71,060 yearly
	In USD
Economic losses	12.5 billion yearly
Workers earnings losses	2.7 billion
Tax Revenues losses	422 million
Personal Income Tax losses	291 million
Corporate Income Tax & Production Taxes losses	131 million

Source: Adapted from "The true Cost of Sound Recording Piracy to the US Economy" by Institute for Policy Innovation (IPI), August 2007

Domestic Music Piracy Levels in 2004				
Region	**Over 50%**	**25-50%**	**10-24%**	**Less then 10%**
North America				Canada, US
Europe	Bulgaria Czech Republic Estonia Greece Latvia Lithuania Romania Russia Serbia/Montenegero Turkey Ukraine	Croatia Cyprus Hungary Italy Poland Portugal Slovakia	Belgium Finland Netherlands Slovenia Spain	Austria Denmark France Germany Iceland Ireland Norway Sweden Switzerland UK
Asia	China India Indonesia Malaysia Pakistan	Phillippines Taiwan	Hong Kong South Korea Thailand	Japan Singapore
Latin America	Argentina Brazil Central America Chile Colombia Ecuador Mexico Paraguay Venezuela			
Middle East	Egypt Kuwait Lebanon	Israel Oman Saudi Arabia	Bahrain Qatar UAE	
Australasia				Australia New Zealand
Africa	Morocco	Nigeria South Africa Zimbabwe		

Note: Domestic music piracy levels are calculated as pirates units divided by legal units plus pirate units
Source: Adapted from "The Recording Industry 2005 Commercial Piracy Report" by International Federation of the Phonographic Industry (IFPI), 2005

In terms of general disc manufacturing, there is production capacity that exceeds demand in a legitimate market by thirteen times overall. The economic impact of piracy is manifold. For example, when pirated marketplace supersedes legal marketplace, the investments into new music are compromised. It does not stop here. In fact, there are also job losses, creativity undermined and the government deprived of tax revenues.

Disc Over-Capacity			
The table below lists the 11 territories with the largest disc manufacturing over-capacity. Capacity exceeds demand by 13 times in these territories combined.			
Territory (Million units)	Capacity	Demand	Over Capacity
Taiwan	10,700	300	10,400
China	5,800	1,100	4,700
Hong Kong	2,700	90	2,610
Malaysia	2,500	60	2,440
Mexico	1,600	110	1,490
Singapore	700	60	640
Brazil	600	120	480
Thailand	600	50	550
Poland	600	150	450
Russia**	450	60	390
Pakistan*	400	30	370
Total	26,650	2,130	24,520

Note: Format include CD, DVD, CD-R/W, DVD-R/W, DVD Rom and Video CD
Source: Understanding & Solutions Ltd
* IFPI National Groups
** Russia Demand: Source is IFPI estimates for CD and DVD only

Source: Adapted from "The Recording Industry 2005 Commercial Piracy Report" by International Federation of the Phonographic Industry (IFPI), 2005
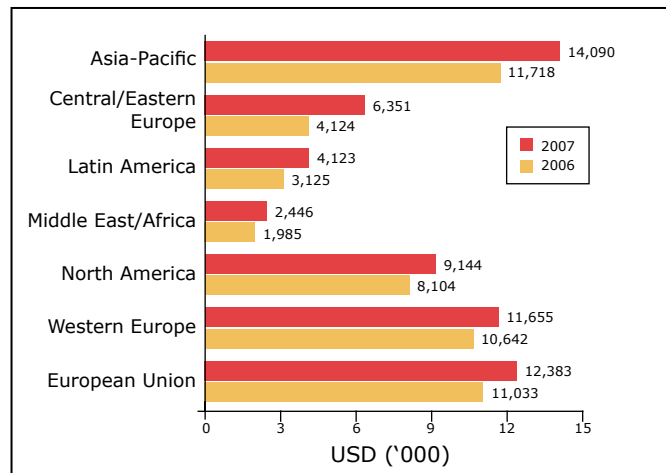
Global Software Piracy by Percentage (%)
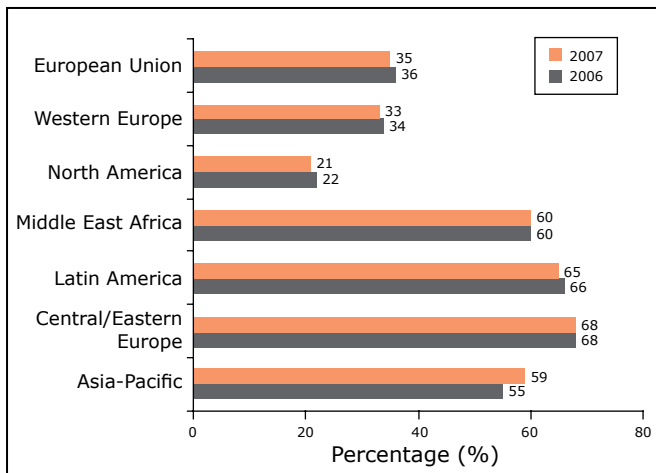
Note: Percentage of software piracy means proportion of illegal versus legal production
Source: Adapted from "Piracy Study 2007" by Business Software Alliance, 2007

Global Losses from Piracy by Region (USD)

Source: Adapted from "Piracy Study 2007" by Business Software Alliance, 2007

It is observed that the global PC software piracy has generally increased in most of the regions worldwide. This could be due to the PC market taking off in emerging economies. As stated by Business Software Alliance, out of "one billion PCs installed around the world, half of them have pirated software and shipped into emerging markets".

Overall, there have been huge losses to piracy in all of the regions worldwide, which could cripple local software industries. It is therefore, a challenge that if piracy is not curbed, the legal market is at risk of more losses across increasingly digitised content production and delivery systems.

DRM DEVELOPMENT

According to MMI, market forces in DRM-based business models are the primary drivers of DRM to expand beyond conventional methods of protection mechanisms. In this respect, fingerprinting and Digital Watermarking (DWM) are emerging enhancements of present DRM.

Protection Mechanisms	Focused Activities
CA	- Protects the network and service delivery, for example, right to view or access the content; the access is "conditional" based on the provider's rules. - Is not limited to whether one has paid for content, but also legal restrictions or limited access under licence. - Conditional access generally does not protect content once it is delivered to consumers' set-top box. DRM is viewed to take over from there.
DRM ● 1. Specific usage	DRM protects premium content when delivered over open networks such as the Internet, or among devices interlinked on a home network, for example, copy-control, home entertainment networks.
● 2. Enhanced usage	DRM as an umbrella reference for a whole system of conditional access, content protection, DWM and fingerprinting as general content monetisation technologies.

Source: Adapted from "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008
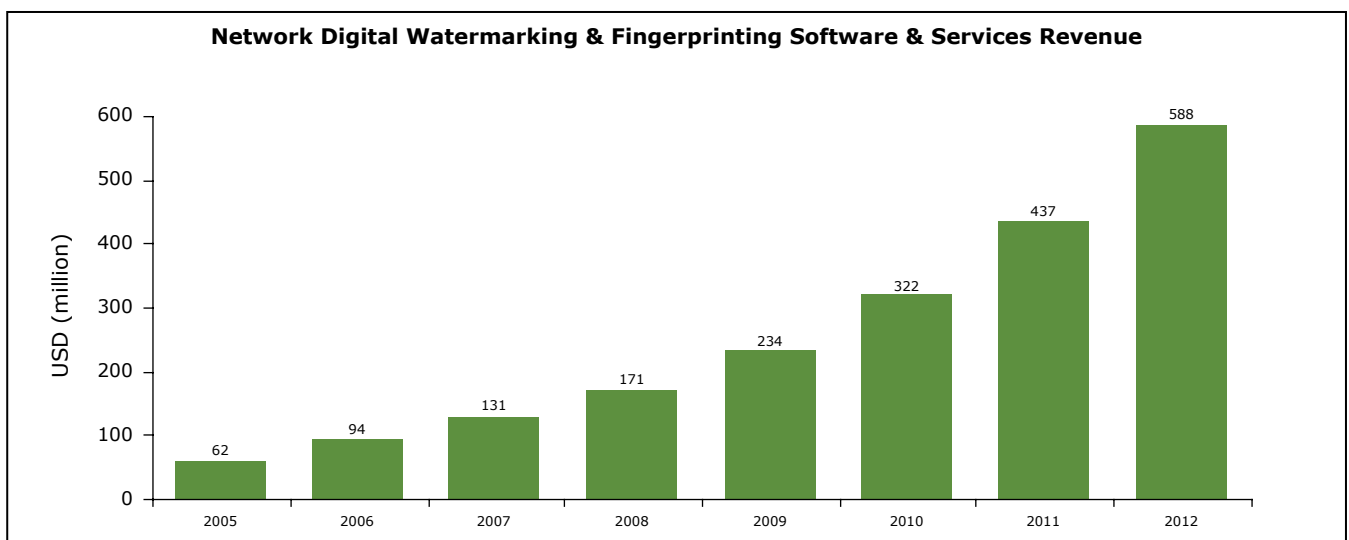
Revenue from Digital Watermarking (DWM) and Fingerprinting

DWM and fingerprinting serve the same purpose of creating evidence of copyright and/ or both can generally be used against any illegal attempt to either reproduce or manipulate the content. However, both differ in terms of technologies used.

DWM solutions are specially developed for mediums such as audio and video. It is a short piece of information integrated with the data and it is difficult to be removed whether intentionally or not. Usually, an invisible mark is inserted in digital content such as images, video and audio so that it can be detected at a later stage.
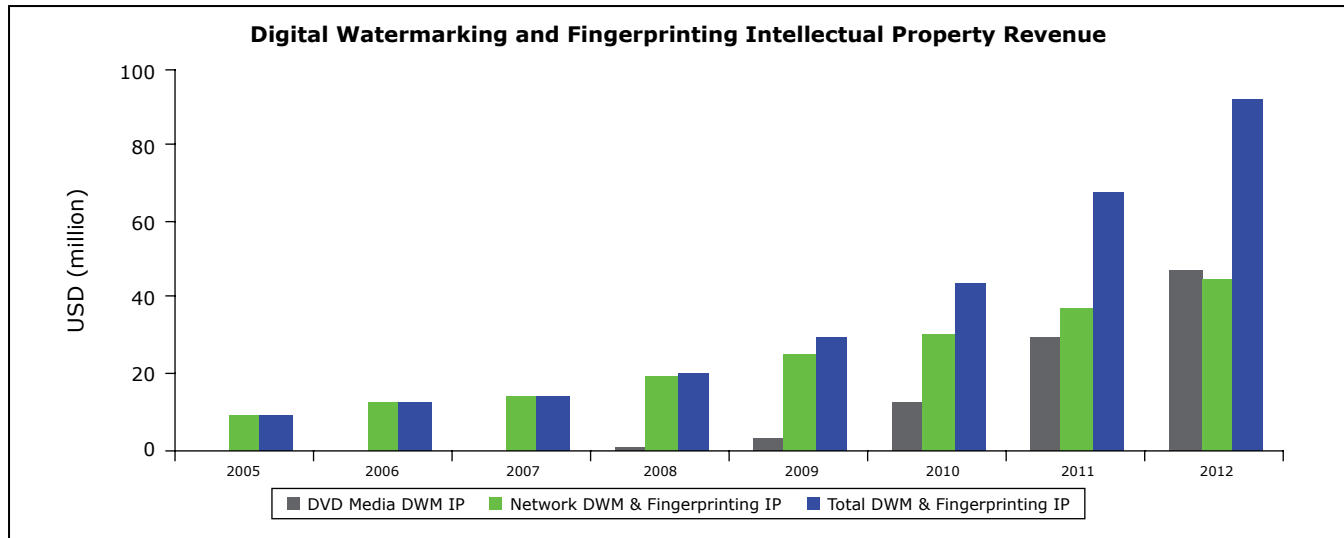
Fingerprinting functions by extracting the characteristics of a file and storing them in a database. So, normally the characteristics of a file are stored in the database called "metadata" for security and verification purposes.

Indeed, the challenges of encryption-based DRM are feeding the growing interest for DWM. DWM also has applications that reach beyond traditional DRM and appear to be suited to non-linear, viral-based content distribution.

Network Digital Watermarking & Fingerprinting Software & Services Revenue

Year	USD (million)
2005	62
2006	94
2007	131
2008	171
2009	234
2010	322
2011	437
2012	588

Source: Adapted from "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008

Although the application market for fingerprinting and DWM is at relatively early stage of development, it is forecast to generate incremental revenue by 15% to 30% through 2012 to USD93 million from USD20 million currently. There is expected increment in not only revenue from software and services revenue, but also revenue derived from the use of the Intellectual Property Rights (IPR) of these technological measures as indicated in the chart below.

Digital Watermarking and Fingerprinting Intellectual Property Revenue

Legend: ■ DVD Media DWM IP ■ Network DWM & Fingerprinting IP ■ Total DWM & Fingerprinting IP

Source: Adapted from "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008

Distribution Network and Protection Mechanism

Since exchange of digital information has made its way through the various digital communications network such as broadcast, physical media, online and the digital home, there is a need for a protection system to ensure that any form of information, be it audio or video is reaching the consumer in a manageable way. This protection system is still evolving in response to the environmental changes and challenges faced by all stakeholders concerned.

Network	Protection System/Features
Broadcast	Essentially CA • Closed distribution network for example; cable, Direct-to-Home (DTH) and terminal equipment such as set-top box • Limited storage • Protection at transport level • Heavy exposure to piracy and hardware security
Physical Media	Copy Control (Copy Protection for Recordable Media or CPRM) • For example; CD and DVD
Online	DRM • Open distribution network for example, Internet and PC • Extensive storage • Protection at application level • Lesser exposure to piracy and software security Software DRM • Securely accessible and downloadable • Lower cost of distribution • Enhances and supports value added bundles • Optimisation of application for the chosen devices • Microprocessor DRM • Hardware DRM
Digital Home	Copy protection (DTCP, HDCP)/ TV + Home Entertainment Networks (HEN) DRM • Point-to-Point secure transmission • Server level for example; media broadcasting, unicasting and encoding • Client level for example; STB and modem • Optimisation of application for the chosen devices

Source: Adapted from "Viaccess and Wireline and Wireless DRM: Securing Content Distribution (2007-2012)" by The Insight Research Corporation, March 2007

Relationship between DRM Implementation Methodologies and Market Segment

	Wireline DRM	Wireless DRM	TV + HEN DRM	Software DRM	Microprocessor DRM
Wireline retail users	✗		✗		
Wireless retail users		✗			
TV + HEN users			✗		
Software application corporate users				✗	
Software application retail users				✗	
DRM intellectual property users					✗

Source: Adapted from "Digital Rights Management: Securing Content Distribution (2007~2012)" by The Insight Research Corporation, March 2007

Examples of DRM Applications	
DRM Solutions	**Description**
Windows Media DRM (Microsoft)	To provide secure delivery of audio and/or video content over an IP network to a PC or other playback devices for Windows Media platform.
Fairplay DRM (Apple)	Digitally encrypts Advanced Audio Coding (AAC) audio files and prevents users from playing these files on unauthorised computers.
Open Mobile Alliance DRM (OMA)	Implemented on many recent phones; is intended to be used by mobile content providers and to ensure interoperability across all implementations for OMA.
Content Scrambling System (CSS) and Advance Access Content System (AACS)	Copy protection for DVD and HD/BD DVD.
Digital Transmission Copy Protection (DTCP)	For compressed video through digital connectivity, such as IEEE 1394 and USB.
High Bandwidth Digital Copy Protection (HDCP)	For uncompressed display connectivity, such as HDMI.
A Copy Generation Management System (CGMS)	For protecting analogue inputs and outputs.
Content Protection for Recordable Media (CPRM)	For recording on removable physical media.

Source: Adapted from "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008

Trends Leading to Enhanced Usage DRM "System"

The changing landscape of content delivery is now moving to include a widening use based on social networking platforms that facilitates proliferation of file sharing and P2P content sharing environments, and other user generated content or UGC. In such cases, enhanced DRM mechanisms such as DWM and fingerprinting are seen to gain traction.

For example[4], certain market segments such as universities, music distributors, broadband access services, telcos and media companies, are looking to deploy such enhanced content management mechanism as follows:

- As universities account for over 15% of piracy in North America and are coming under significant scrutiny from RIAA (Recording Industry Association of America), such entities are reported to consider deployment of fingerprinting technologies for their local networks;
- UMG embeds watermarking in its DRM-free file offering in August 2007. The watermark identifies the song and online-store. These are currently not transactional watermarks[5] with individual purchaser information; and

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[4] *"Beyond Traditional DRM: Moving to Digital Watermarking and Fingerprinting in Media" by MMI, 2008*
[5] *A transactional watermark is embedding information specific to a particular transaction and/or individual into a digital watermark. For example, in digital set-top box application, the watermark is in the form of serial number, identity of the device that is downloading the content item, and/or watermark embedded into premium video delivered to the consumer. If copyrighted content is subsequently illegally distributed, the transactional watermark enables the infringing content to be tracked back to source.*

- One of the telcos in the US is reported planning to work with media companies to reduce copyright infringement on its network using DWM and fingerprinting in managing traffic on broadband networks. Indeed, IPTV security schemes from vendors like Cinea and Verimatrix allow transactional watermarks.

In the coming years, analysts such as MMI see the need for use of fingerprinting and DWM to increase due to the following drivers:

- Proliferation of UGC and social networks;
- Content production companies requiring use of watermarking for HD content;
- Increasing new platforms for content distribution such as IPTV operators and Internet media distribution; and
- Advancing technology in hardware and software enabling lower cost transactional watermarking in consumer electronics.

Applications of Digital Watermarking and Fingerprinting	
DWM	Fingerprinting

1) Content identification
   a. Broadcast monitoring
   b. Supports "take down notices"
   c. Content discovery and association with metadata
   d. Ultimately supports advanced advertising models and e-commerce
   e. Rights holder identification
2) Forensics infringing use
3) Content protection through copy prevention
4) Content authentication/integrity- genuine, authorises source, not altered
5) Content search
	1) Content identification
	   a. Broadcasts monitoring
	   b. Supports "take down notices"
	   c. Content discovery and association with metadata

Source: Adapted from "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008

DWM Application across Distribution Channels and Consumers Devices
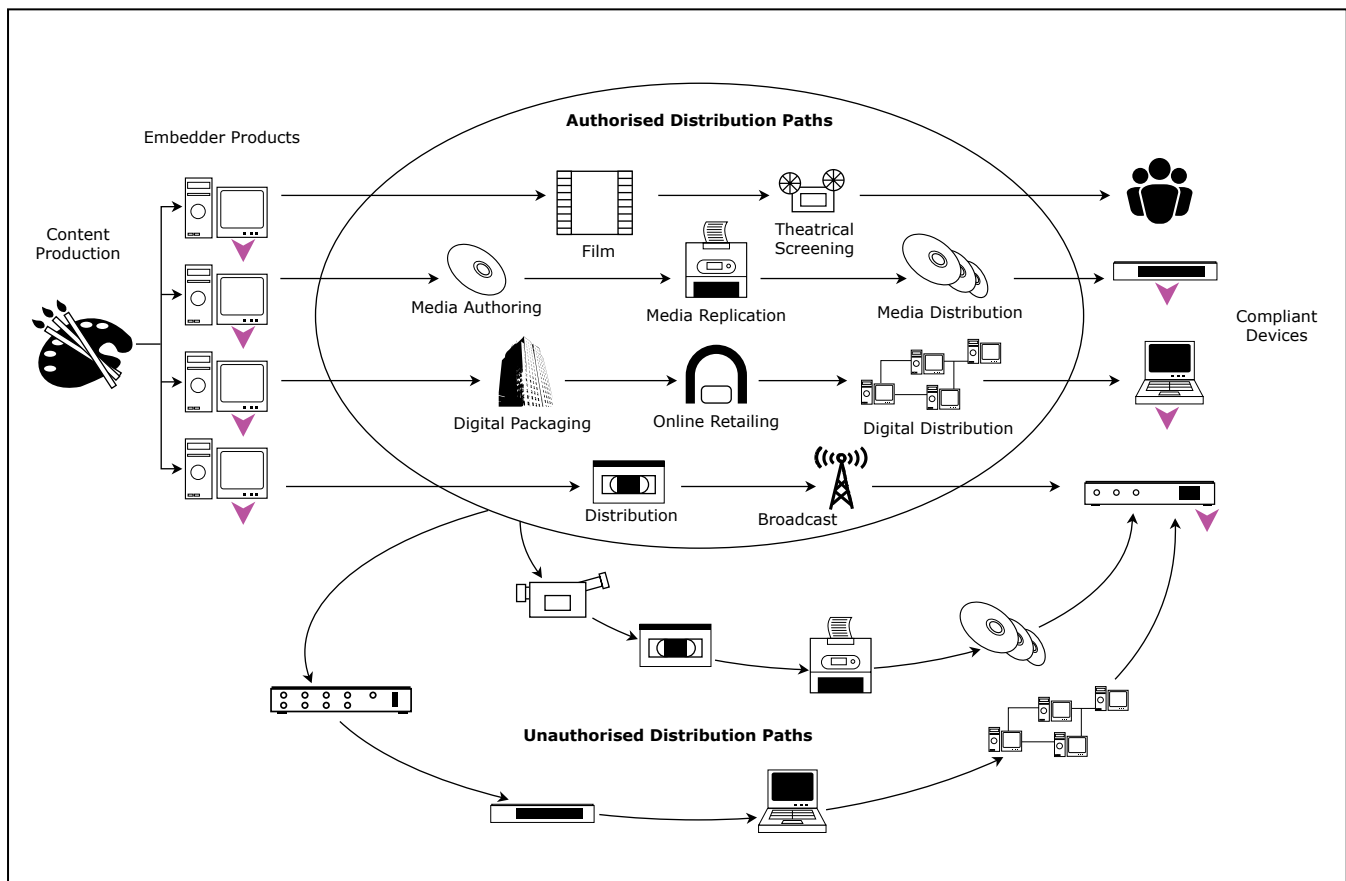
Source: Adapted from "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008

Specific additional features of DWM and fingerprinting are as follows:

1. Audit trail in certain P2P environment to keep track of information access to prevent forgery. This is to ensure that legitimate owners can assert ownership for validity of their data; and
2. A role in facilitating DRM interoperability through transcripting from one DRM scheme to another as content moves among domains and devices. Thereby, providing virtual digital content management across the content delivery chain such as between DRM schemes.

Selected DRM Applications in Context

DRM is applied in a variety of content applications such as:
- Music;
- Video;
- Publishing such as e-books; and
- Games.

Music

DRM exists in various forms embedded in both physical media (CDs or DVDs) and in content distributed online such as songs, e-book and online games, or video-on demand.

Phonographs, radios, vinyl records, magnetic tape and digitised optical discs are among the modern technological advances that are shaped by music. Now, with wireless technologies are also available in marketing strategies, these technologies drive the infusion of music formats and the customer experience. Nevertheless, the prompt availability of downloads raises a few issues in terms of "content providers facing serious problems in protecting their rights over this digital media[6]". Therefore, DRM manages the digital content usage, or the options of purchasing content from respective providers.

Implications for the Future of Mobile Music
• There would be mobile music with or without official services.   • Speed of market penetration depends very much on the consumer behaviour.   • Device manufacturers as well as operators or copyright owners have important roles to play.   • Usability of services is a key to success.   • Ultimately the consumer decides on what services are acceptable or better than others.

Source:Adapted from "Business Models for Mobile Music and DRM", www.indicare.org, September 2004

Video

Content through video delivery modes such as DVDs, satellite, cable, and emerging platforms such as IPTV, web-based downloads, P2P video sharing and mobile video, can be managed through the use of DRM systems. Therefore, the rights owners and distributors can still have control over their digital content in terms of rights protection, monitoring and tracking of content over new transmission mediums.

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[6] *"Advantages of DRM", www.microsoft.com*

Example of Mobile Broadcast Trust Model and Rights Delivery
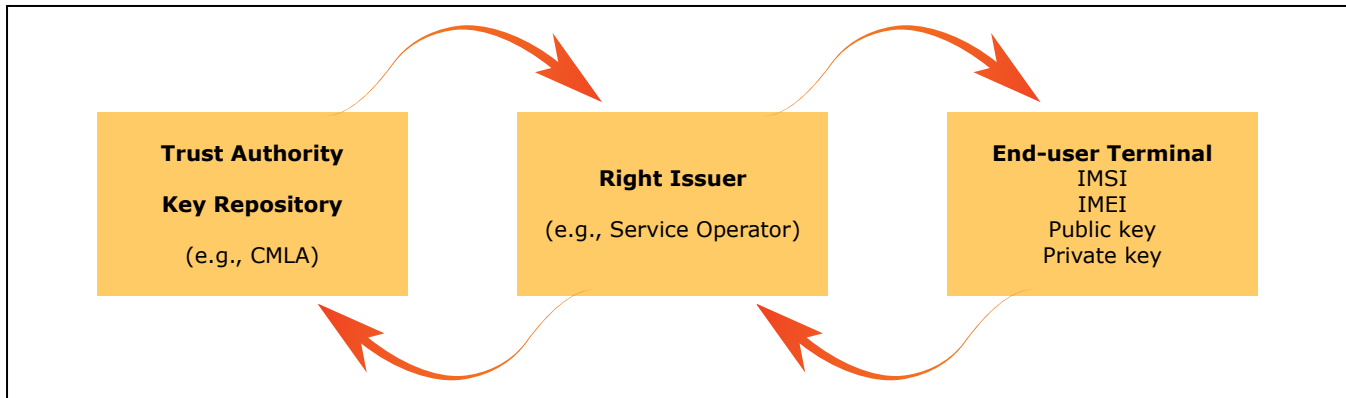
Source: Adapted from "Mobile Broadcast Business Dynamics", www.tml.tkk.fi, 2006

Publishing

A rather new platform for readers is the electronic book or e-book, which is the digital equivalent to a physical book. e-Books can be read from a computer, and Personal Device Assistant (PDA), with the necessary software. Now, there are e-book readers or e-book devices such as Sony reader introduced in the US in 2006 and in Canada and the UK this year, which has digital content management through a DRM system permitting any purchased e-book to be read on a set number of devices. Another e-book reader is the Kindle from Amazon.com. The use of e-Books is expected to gain popularity and potential global distribution. Electronics manufacturers today are producing more e-Book readers for the general consumer.

Games

Overall, there are thought to be three channels of digital distribution for games, namely through the Internet, digital television and mobile Internet. Since all these channels are prone to piracy attacks giving hackers multiple rooms for breach of security, DRM technology is inserted in the form of software called 'Wrapper'.

Wrapper refers to data that is added to the game file as a security measure and works to ensure that only authorised users are allowed access to the content[7]. Today, DRM technology in the games arena is able to support a variety of business models be it subscription, try-before-you-buy and outright purchases.

Games Digital Distribution Market Value Chain
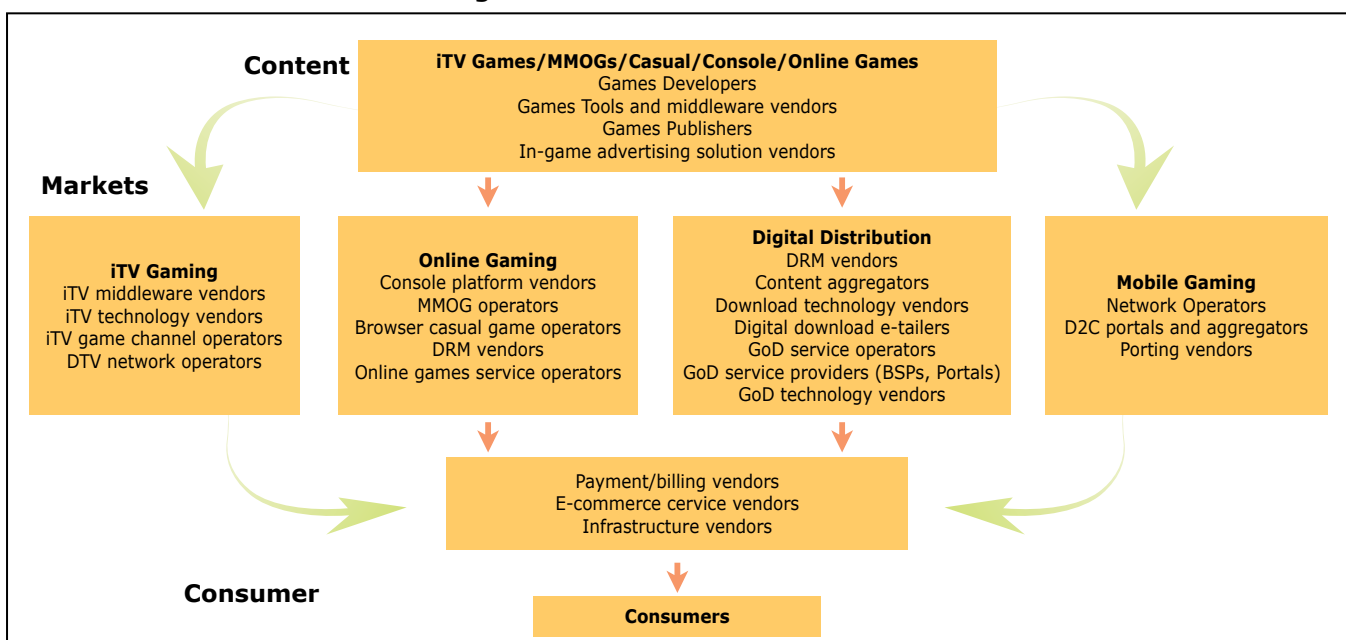
Source: Adapted from "The Interactive Content and Convergence: Imlications for the Information Society" by Screen Digest, October 2006

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[7] *"Interactive Content and Convergence: Implications for the Information Society" by Screen Digest, October 2006*

BASIC DRM COMPONENTS

It is noteworthy that DRM technology is not a piece of software. It is a combination of several technologies and services, which include identifiers, metadata, rights languages, encryption, and technologies, for establishing the link between content and metadata, that is, persistent association technologies, and those related to ensure privacy and secure payment. These various components of DRM are described in the table below:

Types of DRM Components		
Technologies	**Functionality**	**Remarks**
Identification	Ascription of a label to content so that it is unambiguously identified for another party. For example, ISO 15707 as the International Standard for musical Work Code (ISWC)	ISWC identifies musical works, that is, the underlying "abstraction" of a piece of music such as "Beethoven's Fifth". ISWC plays a central role in rights management in music so that the rights holders are able to obtain requisite funds from its usage.
Metadata	Used to describe DRM-protected content in the media object. Metadata essentially is information that describes content (which is the "data") in an unambiguous way.	For example, a metadata can exist to identify the content (location information, for example, a Uniform Resource Identifier (URI), similar to a web address). Another type helps the user understand what the media object actually is (descriptive metadata, for example, the artist and title of a song).
Rights Expression Languages[8] (REL)	REL provide a concise mechanism for expressing rights over DRM content such as content preview before purchase. REL express various permissions, for example, user can play a song but not forward it; and express constraints such as user can play the song only ten times.	Essentially, REL set a range of obligations, permission and constraints required by the rights entity. In the field of DRM, REL essentially express such requirements in the form of rules comprising both a vocabulary (semantics) and structure (syntax), which can be machine readable, that is, in the form of a computer language system.
Encryption	DRM encryption technology manages the keys (public and private keys) to allow access to encrypted content.	Using public and private key technology for DRM provides advantage in terms of ensuring that content is locked to a particular user or device. Security and convenience of these key management processes distinguish between "good" or "bad" DRM systems.
Persistent Association	Persistent association technologies are used to meet the high-level requirements for consistently attaching information to content such as watermarking; fingerprinting; and digital signature linked to authorising changes in metadata.	Main requirements of persistent association technologies or include ability to establish link between content and metadata with high accuracy; does not degrade the quality of content; and allows for anti-piracy services.
Privacy	Privacy Enhancing Technology are (PETs) include the use of anonymising technologies which permit identities to be authenticated by trusted third parties, without the actual identity of the consumer being disclosed.	PETs in the DRM infrastructure are expected to be important to ensure long term consumer acceptance of the implementation of DRM. PET is more than simply a means of protecting personal data; it also enhances quality information with dependency reducing processes and procedures made compliant by automatic enforcement of privacy regulations. It offers the public a better insight of and control over their personal data.
Payment	Payment technologies or systems in the DRM context allow secured payment such as using credit over the web to purchase content.	The Secure Sockets layer (SSL) protocol provides encryption for web-based payment using credit card. Other online payment systems include micropayment systems over mobile phones for low price transactions such as downloads of music, ringtones, and e-Books. For instance, iPOD owner can subscribe a package of three in one (downloader+converter+iPOD uploader) at USD24.99, and subscribers can enjoy the benefit of full licensed product for unlimited downloading and prompt technical support. Also, it offers a trial period, for example, three days. (http://youtubeipod.net/index.htm).

Source: Adapted from "World Intellectual Property Organization Standing Committee On Copyright and Related Rights", www.wipo.int, November, 2003; "Digital Rights Management and Consumer Acceptability" by INDICARE, December 2004; "White Paper for Decision Makers" by Privacy Enhancing Technologies (PETs), December, 2004

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[8] *A standards forum known as MPEG 21 is working to create a standardised REL structure and vocabulary*

DRM-based Business Models

Copy protection and monetising content should not be the only reasons for the implementation of DRM systems. Another important goal is to develop business models on the basis of DRM to offer value added to the customer.

Business Models through the Use of DRM	
Pay-per-Use	This model is similar to the pay per download model except that here the content object requested by the user is being streamed (customer does not own the content but only has the right to access for immediate consumption) instead of downloading it. The usage right is also restricted to just one single use of the content.
Subscription	A subscription allows customers to access the content over a period of time with the start and end dates. The access is terminated once the subscription is not renewed.
Rental	Rental models are based on content streaming. This is similar to pay per use but the customer would be able to stream the content as many times as they want within the limited period, say within 24 hours.
Bundling	Digital content is offered in a bundle (number of content objects).
Price and Product Differentiation	Allows for alternative market offerings at different prices. This means that price access to a recently released movie or song would be different when the same piece of content is several months old.
Superdistribution and Viral Marketing	Allows customers to forward the digital content to others. The forwarded content is limited in usage to the recipient until the person obtains full licence to use it. This is because the DRM content and rights to access is transmitted separately.
Preview and Sampling	This model is used to enforce special promotional licences. Customers can be allowed to listen to the preview or sampling of the song once or twice only before purchasing the song.
Forensic DRM Models	Digital content files are watermarked or fingerprinted to prevent copyright infringements. A digital user certificate is also attached to the content to trace back the origin of copied content.

Source: Adapted from "Digital Rights Management and Consumer Acceptability" by INDICARE, December 2004
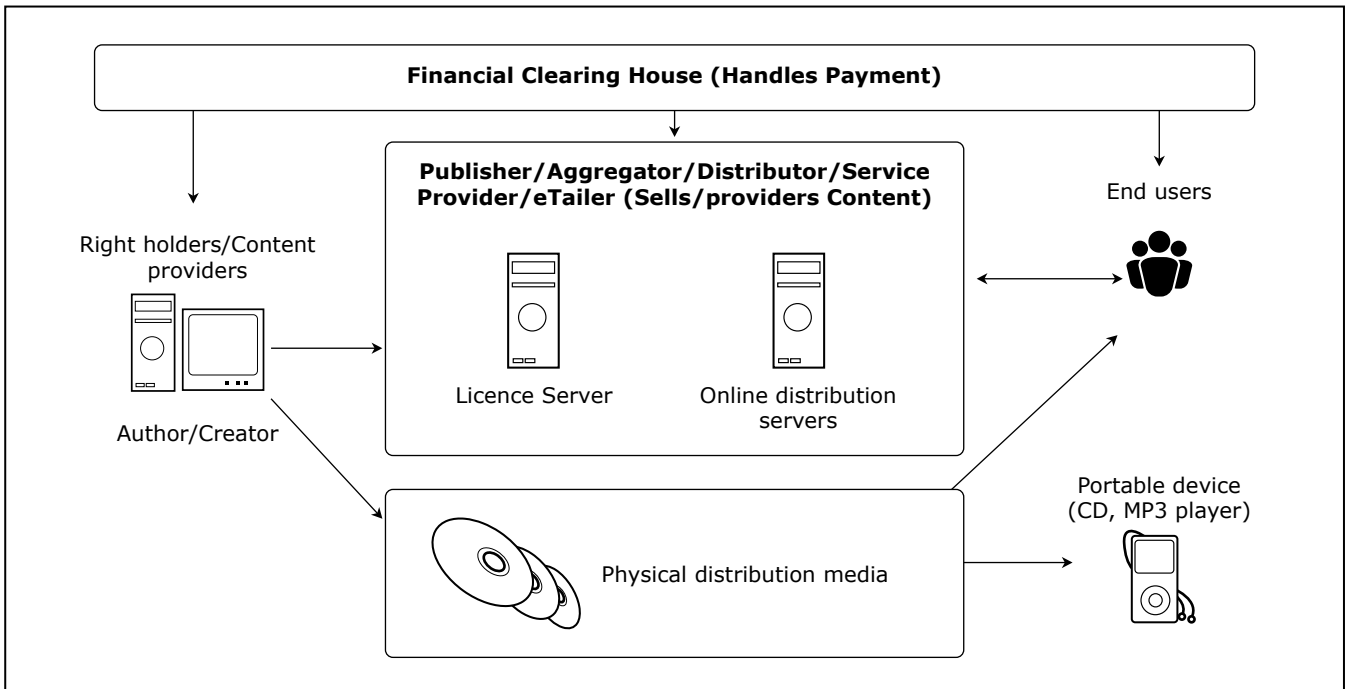
The Process of DRM

The process of DRM starts with content provider encoding the content into a format supported by the DRM software. The content is now encrypted and packaged using special usage rules or licence key saved on the licence server or on the physical distribution mediums such as CD, DVD or VCD. Usage rule, or in other words, business model can be pay-per-download, pay-per-use, subscription model and the like.

Normally, the DRM system is integrated with an e-commerce system that takes care of the payment process when requesting a licence key from the licence server or requesting for important or useful documents from the online distribution servers.
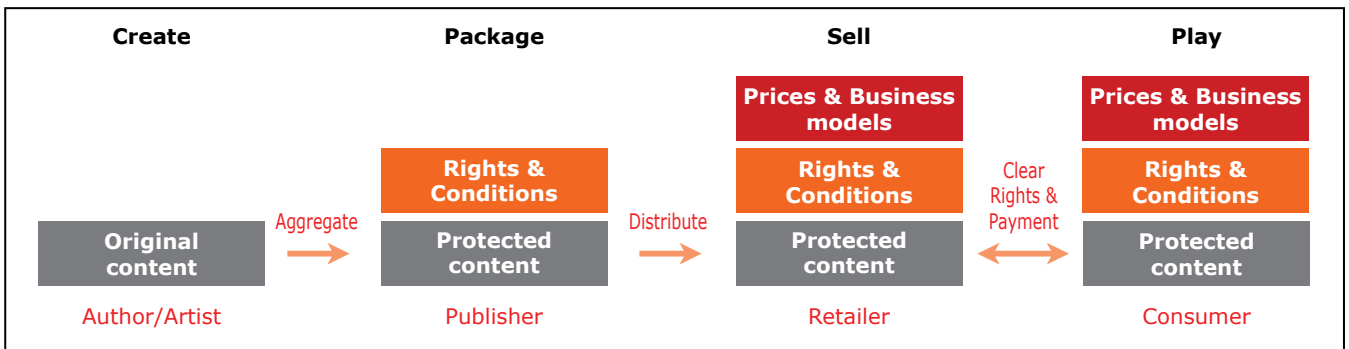
Content is then released to the customer upon receipt of payment.
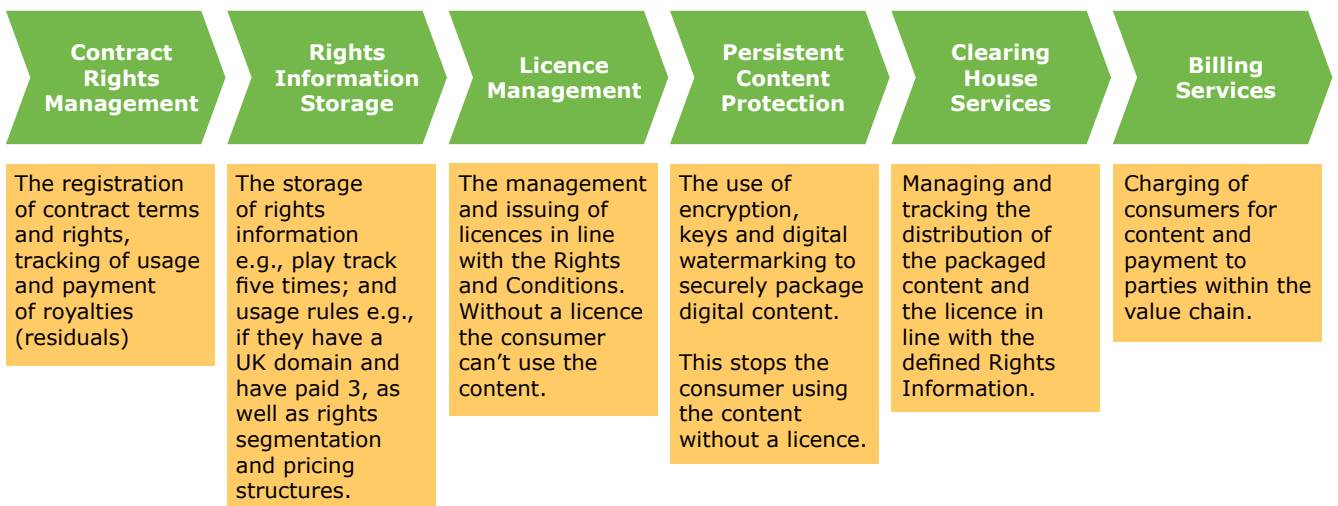
DRM in Conceptual Form -The Process of DRM

Financial Clearing House (Handles Payment)

Publisher/Aggregator/Distributor/Service Provider/eTailer (Sells/providers Content)

Right holders/Content providers

Author/Creator

Licence Server

Online distribution servers

End users

Physical distribution media

Portable device (CD, MP3 player)

Source: Adapted from "Digital Rights Management White Paper" by Sonera Plaza Ltd, MediaLab, February 2002

End-To-End DRM in Multimedia Commerce

Create	Package	Sell	Play
		Prices & Business models	**Prices & Business models**
	Rights & Conditions	**Rights & Conditions**	**Rights & Conditions**
Original content	**Protected content**	**Protected content**	**Protected content**
Author/Artist	Publisher	Retailer	Consumer

Aggregate → Distribute → Clear Rights & Payment →

Source: Adapted from "DRM-Enable Business Models in Multimedia Commerce" by Contentguard, 2005

DRM Value Chain Activities

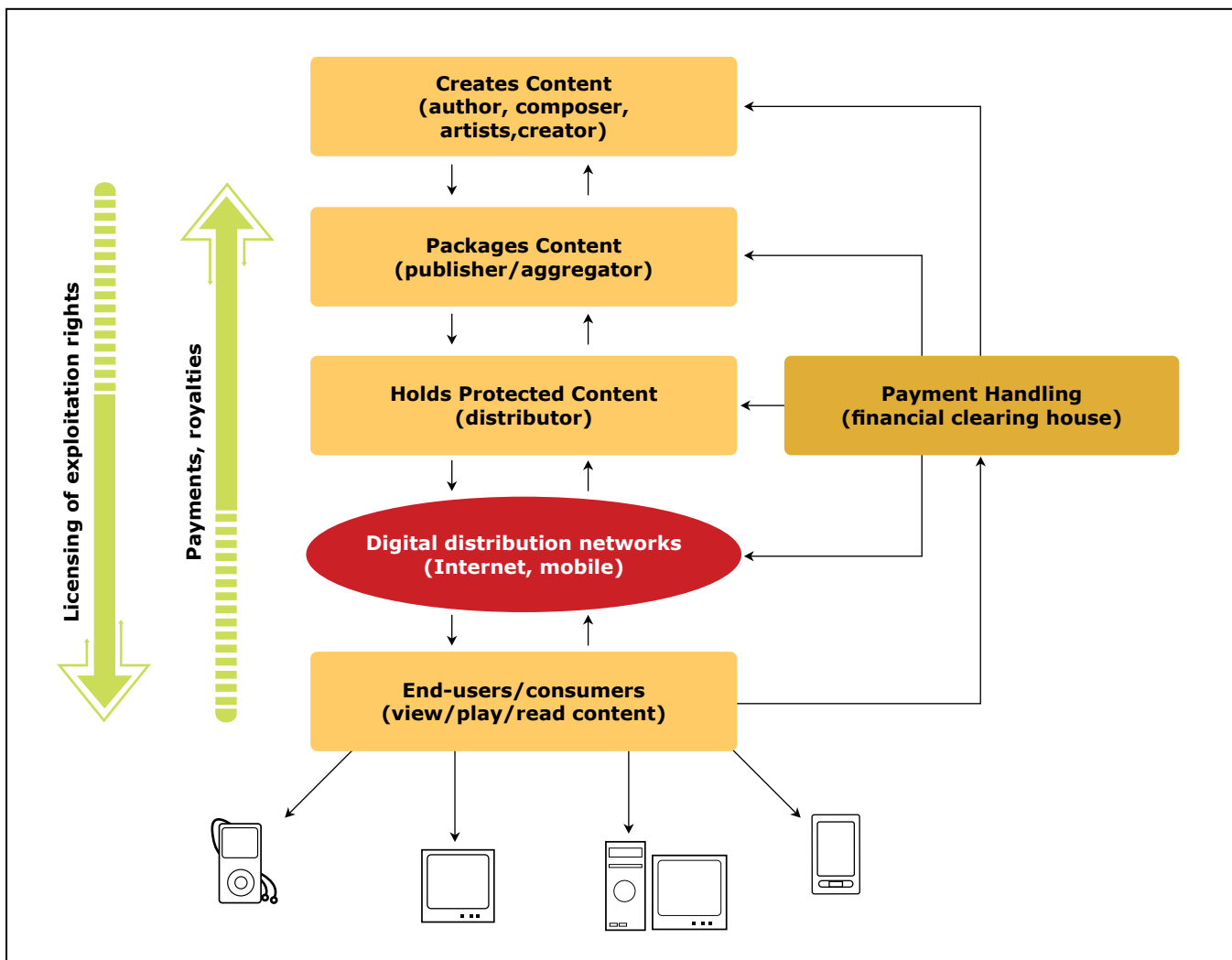| Contract Rights Management	Rights Information Storage	Licence Management	Persistent Content Protection	Clearing House Services	Billing Services
The registration of contract terms and rights, tracking of usage and payment of royalties (residuals)	The storage of rights information e.g., play track five times; and usage rules e.g., if they have a UK domain and have paid 3, as well as rights segmentation and pricing structures.	The management and issuing of licences in line with the Rights and Conditions. Without a licence the consumer can't use the content.	The use of encryption, keys and digital watermarking to securely package digital content.\n\nThis stops the consumer using the content without a licence.	Managing and tracking the distribution of the packaged content and the licence in line with the defined Rights Information.	Charging of consumers for content and payment to parties within the value chain.

Source: Adapted from "A Comprehensive Approach to Digital Rights Management: Towards A Unified DRM?" by Capgemini, 2006

Conceptually in a value chain, each component and entity at different levels are called actors or users irrespective of whether they are at the beginning or at the end of the value chain. This is because there are different users at different levels of the value chain who have or share different roles or activities to be performed at any points in time. These actors perform certain functions between each other. These functions are usually implemented using tools as represented through the underlying technologies.

The digital rights management value chain applies the concept as indicated. It outlines a series of activities that are taking place throughout content transmission, starting from the author or artist of the content until it reaches the end user. These levels of activities are performed in an enterprise or businesses to turn inputs as in content created into value-added output mainly for revenue generation. Other purposes include curbing piracy, copy protection, activity monitoring and so on. The underlying technologies that support or help this to happen are the device, network or software. Developments in such infrastructure, hardware and software collectively bring significant changes in the way businesses can deliver electronic data to customers.

DRM Value Chain

Source: Adapted from "A Comprehensive Approach to Digital Rights Management: Towards a United DRM?" by Capgemini, 2006; "Interactive Content and Convergence: Implications for the Information Society" by Screen Digest, October 2006

WORLDWIDE DRM WORKING GROUPS

DRM has evolved in response to the challenges of managing and monetising huge amounts of online digital content. However, current DRM can support only specified sharing of content between relatively small groups of multimedia terminals. Hence, these systems still lack simplicity and flexibility across multiple channels or systems. The emergence of various working groups discussing DRM, with a view to interoperability and further enhancement of the technology, is expected to in time assist in the crossing of many hurdles en-route to more "mass market" services.

Various incentives by interested parties or other stakeholders with vested interest have brought on the existence of such movement, for example, the mutual goals to provide additional protections for their copyright work. Such movement also allows stakeholders to recoup some of their copyright-related costs and lost revenues, while working to expand market share through collaborative approach or collective solving of mutual problems or hurdles in the new emerging digital media ecosystem.

Incompability of DRM systems, however, still remains an issue as the lack of interoperability between devices and services limits user options in terms of which service they can decide to use. This situation brings members of working groups to focus in achieving interoperability as a high priority. The following list cites DRM Working Groups:

DRM Movement and Focus

DRM Working Group			
Group/Company	**DRM Service**	**DRM Focus**	**Application Environment**
Coral Consortium (www.coral-interop.org/)	Coral	Cross-industry group to promote interoperability between DRM technologies used in the consumer media market; and to create a common technology framework for content, device, and service providers, regardless of the DRM technologies they use. This open technology framework will enable a simple and consistent digital entertainment experience for consumers.	Home network; Open network
Content Partner/System Partners	Promoter Members: Hewlett-Packard Corporation, IFPI, Intertrust Technologies Corporation, Koninklijke Philips Electronics N.V., LG Electronics, Matsushita Electric Industrial Co., Ltd., NBC Universal, Inc., Samsung Electronics Co., Ltd, Sony Corporation & Twentieth Century Fox Film Corp Contributor Members: British Telecommunications PLC, Cloakware Inc., EMI Music, Gibson Guitar Corporation, INKA Entworks, INKA Entworks, Kenwood Corporation, Motion Picture Association of America, Motorola, NXP Semiconductors, PacketVideo, Recording Industry Association of America (RIAA), SecureMedia Inc., Sony BMG, Starz Entertainment, LLC, STMicroelectronics, N.V., Thomson, Universal Music Group, Verimatrix, Inc., VeriSign, Inc. & Warner Music Group		
Digital Transmission License Administrator (www.dtcp.com)	DTCP/5C	Joint Collaboration of five companies as Copy Protection Technical Working Group (CPTWG) members on providing specification to manufacturers with a simple and inexpensive implementation besides maintaining a high degree of protection.	Entertainment Content (Audio/Video); Home Network
Content Partner/ System Partners	Intel Corp., Hitachi Ltd., Matsushita Electric Industrial Co. Ltd, Sony Corp., Toshiba Corp		
Advanced Access Content System License Administrator (www.aacsla.com)	AACS	Developing the Advanced Access Content System, a specification for managing content stored on the next generation of pre-recorded and recorded optical media for consumer use with PCs and CE devices.	Content Storage (e.g., Home Media Server)
Content Partner/ System Partners	IBM, Intel, Microsoft, Panasonic, Sony, Toshiba, Disney, Warner Bros. Studios		

DRM Working Group (continued)			
Group/Company	**DRM Service**	**DRM Focus**	**Application Environment**
SVP Alliance (www.svpalliance.org)	SVP™	Open technology specification for digital content protection that provides superior protection for superior content, extends content protection beyond the set-top box; integrates easily with existing content distribution networks, increases content use and revenues, supports gateways to other solutions; and enables consumers to copy digital content securely in the home.	Home network; Open network
Content Partner/ System Partners	ADB, AMD, Amstrad, Broadcom, BSkyB, Caton Overseas, Cablevision, Conexant, DIRECTV, Humax, LG Electronics, Macrovision, NDS, NEC, pace Micro Technology, Philips, Samsung Electronics, ST Microelectronics, Texas Instruments, Thomson, Twentieth Century Fox and Widevine ® Technologies		
ISM Alliance (ism-alliance.tv/)	• ISMA Encryption & Authentication Specification 2.0 (ISMA Cryp 2.0) • ISMA Specification 2.0 • ISMA Encryption & Authentication Specification 1.0 • ISMA Specification 1.0.1 • ISMA Closed Caption specification	A group of industry leaders in content management, distribution infrastructure and media streaming, has joined together to promote open standards for developing end-to-end media streaming solutions. The founding companies believe that their collaborative efforts will accelerate the broad market adoption of open standards and interoperability, while encouraging the development of competitive solutions.	Home network; Open network *(Notably absent, so far, are streaming giants Real Networks, Microsoft, Akamai, and iBEAM, to name a few)* *
Content Partner/ System Partners	Apple, Cisco Systems, Kasenna, Philips, Sun Microsystems, Advis Inc., Analog Devices Inc., Axis Communications, AB, Bit Band Technologies Inc., Bright Alley B.V., Envivio, e-Vue, Inc., Informix Media 360, iVAST Inc., Luxxon, Macrovision Corporation, Mighty Eyes, Minerva Networks, nCUBE, Network Appliance, Optibase, PACKETVIDEO Corporation, Pix Stream Inc., Sea Change International, SGI, Sigma Designs Inc., Streaming21 Inc., VCON, and Virage Inc.,		

*www.internetnews.com

Note: A quick reference on list of Organisations and Standards for DRM 2006 is available at http://xml.coverpages.org/Lyon-NIST241assmOct9.pdf

Source: Adapted from various websites

DRM Technology Vendors

For ease of reference and discussion in this section, we have separated the major vendors into the "conventional DRM" and the newly enhancing or lately, gaining prominence vendors of "digital watermarking and finger printing".

Major Vendors (Conventional DRM)

Generally, the major DRM companies listed here focus on offering solutions across a broad range of applications and technologies as indicated:

Conventional DRM Vendors			
Company	Content & System Partners/Customers	DRM Solution Product	DRM Solution Features:
Apple Computer (www.apple.com)	Proprietary	Fairplay	DRM-protected music files purchased from the iTunes Store are protected by FairPlay, Apple's digital rights management system. FairPlay allows you to play your music on up to five computers at a time (and enjoy unlimited syncing with iPods), burn an unlimited number of individual songs to disc, and burn playlists up to seven times each. **Application environment: Music industry**
RealNetworks (www.realnetworks.com)	ABC News, Avid, CNN, NASCAR, Starz Encore	Helix	Helix Server is, so far, the only multi-format, cross platform streaming server for delivering the high quality experience to wired and wireless devices. **Application environment: Content server**
Microsoft (www.microsoft.com/windows/ windowsmedia/forpros/drm/ default.mspx)	BMG, EMI, Buymusic, CinemaNow, Movielink, Music Now, LionGate, Warner Music, Sony Music, Universal Music, etc.	Window Media DRM 10	A platform to protect and securely deliver content for playback on computers, portable devices, and network devices. The latest version offers increased flexibility to support a wide range of business models that provide consumers even greater access to protected audio and video content. **Application environment: Music industry**
Sun Microsystems (www.sun.com)	Proprietary	DReaM	Solution focusing on open standards-based-solutions. It integrates with available solutions by providing openness and interoperability. Also, it introduces rights management services that leverage open standards and support cross-service capabilities. **Application environment: Home network; Open network**

Note: In fast-paced in DRM field, the lifespan of some web link may be changed hence URL cannot be guaranteed
Source: Adapted from various websites

Major Vendors (DWM and Fingerprinting)

The pace of change in ways to distribute digital content online seamlessly has significant impact on the digital content ecosystem in its progress towards a converging multimedia environment. These developments drive the need for technology beyond conventional DRM. Hence, "Fingerprinting and DWM play a key role in the copy protection system, as well as the content and copyright management system, and ultimately advertising insertion[9]".

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[9] *"Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008*

The following tables show the main vendors of these technologies, namely broad-based solution providers and technology, IP; and software companies.

Broad-based Solution Providers			
Company	Content & System Partners/Customers	DRM Solution Product	DRM Solution Features
Philips Content Identification (www.business-sites.philips.com/contentidentification)	Anystream, Avid Techologies, Digimarc, Digital Rapids, Keycode Media, MediaGrid, Telestream & Teletrax	MediaHedge	Supports various media recognition, crawling and monitoring technologies which apply across the media and Internet industry.
Thomson (www.thomson.net)	Agnostic, Anystream, Digital Rapids, Inlet Technologies, ROOT6 Technology, Telestream, SeaChange, Thomson Grass Valley	(i) NextGuard (ii) NexTracker	(i) Provides comprehensive protection of content from pre-production through distribution to the consumer. (ii) Focuses on supporting broadcast monitoring and verification of programme integrity

Note: These companies participate across various categories mentioned, so the categorisation should not be viewed as exclusionary
Source: Adapted from various websites

Technology, IP and Software Companies			
Company	Content & System Partners/Customers	DRM Solution Product	DRM Solution Features
Activated Content (www.activatedcontent.com/watermarking.asp)	Audible Magic, Digimarc, The International Federation of the Phonographic Industry (IFPI), Microsoft, Sony BMG, Universal Music, Viacom, Warner Bros.	(i) Activor SDK™ (ii) Activor WebStore SDK™ (iii) Activor Pre-Release™	(i) Provides integration facility which allows custom-made chosen watermarks depending on format and metadata required. (ii) Supports in watermarking music downloads in web store environment. (iii) Facilitates to track Pre-Release content by watermarking allocation, metadata management, and unique disc labeling.
Cinea (www.cinea.com)	Broadcom,Conax, Nagravision, NDS,ST Microelectronics,Texas Instruments,Viaccess, Widevine Technologies	1. Consumer Watermarking Technologies: ● Running Marks 2. Professional Copy Protection Solutions: ● S-VIEW ● S-TRACK ● DIGITAL CINEMA	● **Running Marks**: Forensic Watermarking enables a unique, session-specific ID or serial number to be placed in every video stream sent from a system operator into a home. By uniquely watermarking individual streams, pirated content can be traced back to the original source. ● **S-VIEW & S-TRACK and DIGITAL CINEMA:** Various functions of solutions which make it difficult and costly for pirates to steal the content.
DataMark Technologies Pte Ltd ("DataMark") (www.datamark-tech.com)	Axis Communications, ST Electronics (Info-Security) & ST Electronics	StegMark ImageLITE	Software solution that enables the authentication of image captured by Hewlett Packard (HP) scanner and should be able to detect any alterations being made from original one. Also, users are able to digitise their scanned certificates and documents and watermark the details of their copyright information.

Technology, IP and Software Companies (continued)			
Company	**Content & System Partners/ Customers**	**DRM Solution Product**	**DRM Solution Features:**
Digimarc (www.digimarc.com)	Adobe, AquaMobile S.L, brandprotect, Cinea, Inc., Corel Corporation, eMotion, Inc., Equilibrium, GCS research LLC, L-1 Identity Solution, MarkAny Inc., Mobile Data Systems, Inc., MediaGrid, MSI, Nielsen Media Research, Royal Philips Electronics, Scene7, Signum Technologies, Telectrax, Thomson, Ulead Systems, USVO, VCP, Verance, Verimatrix, Widevine	• Link from Print-to-Web • Communicate Ownership • Authenticate Content and Objects • Monitor Broadcasts and Internet Distribution • Identify and Manage Content • Manage Digital Rights • Deter Counterfeiting and Piracy • Secure and Authenticate IDs	Digimarc technology enables many solutions provided by their partners. They provide a wide range of applications for music, movies, television, radio, mobile devices, printed materials, government-issued IDs and even geospatial applications. Digimarc's technology provides the means to infuse persistent digital information — that is imperceptible by humans — into the media and objects. The company's technology protects content from piracy, supports new methods of media distribution, and enables new entertainment experiences.
MediaGrid (www.MediaGrid.com)	Grid Institute, Boston College, Sun microsystems, IHPC, The City of Boston's Create Boston Initiative, IGT, MediaMachines, Japan's University of Aizu, Knowledge Web, Amherst College, Columbia University, MIT, New Media Consortium,NASA, Synthespian.	The Media Grid "spine" combines the public Internet backbone with service providers; enables any application connected to the Internet to access Media Grid services. The Grid Gateway specification defined by the Grid Gateway Technology Group (GGTG) details how service providers connect to, and interacts with, the Media Grid network.	A computational grid platform that provides digital-media, delivery, storage and processing (compute) services for a new generation of networked applications. The Media Grid is powered by service providers (such as rendering farms, clusters, high-performance computer systems, computational grids, and similar systems) that furnish on-demand services to Media Grid clients (users). Specification-compliant Grid Gateway software runs on Media Grid network nodes.
Verance (www.verance.com)	Universal Studios, Sony Pictures Entertainment, Warner Music Group, Mircosoft, Panasonic, Sony Electronics & Toshiba	**1. Copy Motion Motion Pictures & TV:** Cinavia Management System for Audiovisual content (formerly known as VCMS/AV). **2. Music -** The Verance Copy **3. Management System for Audio content** (VCMS/A) **4. Production & Distribution Services:** Verance audio watermark technologies + Cinavia detector specifications and implementations are currently available, and provide component and product manufacturers with the implementations and support	1. Cinavia is a technology platform that employs Verance's proprietary audio watermarking techniques to enable the communication and enactment of use policies for audiovisual content across a broad range of distribution channels and devices. 2. VCMS/A is the industry Standard solution for copy protection within the DVD-Audio, SD-Audio, and SDMI Portable Device consumer product formats 3. These technologies provide emerging high-definition and digital distribution formats with a new dimension of content protection, safeguarding theatrical release, home video, and high-resolution /surround audio against key threats, including in-theater camcording, unauthorised Internet redistribution, and home copying. Standard solution for copy protection within the DVD-Audio, SD-Audio, and SDMI Portable Device corporation 4. AACS LA, the industry consortium responsible for the content protection architecture of the Blu-ray format, has adopted detection of Cinavia watermarks as a required component of Blu-ray players manufactured under its "final" licence agreement.

Technology, IP and Software Companies (continued)			
Company	**Content & System Partners/ Customers**	**DRM Solution Product**	**DRM Solution Features**
		necessary to achieve easy integration of Verance's technology into their products **5. CE& Software- Cinavia for Blu-ray Players** **6. VCMS/A for DVD and SD- Audio Players and Recorders:** VCMS/A detector specifications and implementations are currently available and provide component and product manufacturers with the implementations and support necessary to achieve easy integration of Verance's technology into their products	5. 4C Entity, the industry consortium responsible for the content protection architecture of the DVD-Audio and SD-Audio formats, has adopted detection of VCMS/A watermarks as a required component of DVD and SD-Audio players and recorders that incorporate CPPM and CPRM technology.
Vobile (vobileinc.com)	Steamboat Ventures, AT&T Customers: major content owners and content publishers	VideoDNA™ technology: a solution specifically designed for live broadcast events such as the 2008 Beijing Olympics games. (offers broadcasters and rights holders real-time digital fingerprinting, fully automated identification, and tracking and monetisation of live media	- A ground breaking technology that sets the benchmark in video identification. The significance of VideoDNA™ to videos parallels that of human DNA to humans VideoDNA™ is a unique and robust identifier that can be extracted from video content and then used to identify the video content.

Note: These companies participate across various categories mentioned, therefore the categorisation should not be viewed as exclusionary
Source: Adapted from various websites

COPYRIGHT AND THE DEVELOPING LEGAL FRAMEWORK

Copyright and DRM

Copyright has historical roots and debates that go way back in time. Now, the era of digitisation has all stakeholders re-looking "copyright" through the digital lens, so to speak. In the context of DRM, the issue of and debate on copyright is no less intense – this is from the perspectives of the stakeholders such as copyright owners, content aggregators and distributors, legal fraternity, policy makers, consumer associations and consumers.

An INDICARE report[10] indicates that DRM is not only about rights management, but also about digital content management. From the digital content management perspective therefore, the impact of DRM is seen to go beyond the sphere of copyright law as it affects not only how consumers consume digital content and how they benefit from it. DRM manages the relationship between the providers of digital content and consumers. As paying customers as opposed to pirates, consumers should not be unnecessarily burdened, that is, DRM is not about content protection at any price. Consumer acceptance of DRM is another factor to consider in DRM implementations.

Joint dialogue is important to sort out the legal, economic, social and technical issues in DRM and copyright in a world that is increasingly going digital. The INDICARE report also called for transparency in the debate, that is, of who does what and with which outcome, thus offering opportunities for joint dialogue beneficial for enhancing thinking and debate.

Copyright Provisions in Digital Environment

The digitisation of all types of content has prompted the call from stakeholders to ensure copyright and the use of DRM, including provisions against circumvention, are properly instituted in legal framework. Hence, the WIPO Treaties in 1996, that establishes common and basic legal norms for protection of technical measures used such as DRM.

Member countries are following up with implementation as indicated in the two tables below:

Copyright Provisions under International Law		
Berne Convention for the Protection of Literary and Artistic Works	Early days and revised 1988	Deal with copyrights, together with Paris Convention for Protection of Industry Property and others
Rome Convention*		Deals with three kinds of neighbouring rights or rights related to copyright: those of performers, phonogram producers and broadcasting organisations
WTO TRIPS agreement**	Effective 1995	Established common and basic international legal framework for protecting copyrights and other intellectual property, and for enforcing those rights domestically.
WIPO Treaties***	1996	Established new international legal norms for protection of technical measures used such as DRM, to safeguard content from unauthorised access and use. On a specific note, the WIPO Treaties permit contracting parties to use existing legal remedies against the circumvention of technological measures, including DRMs.

The International Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organisations
**World Trade Organisation Agreement on Trade-related Aspects of Intellectual Property Rights at http://www.wto.org*
***Comprises the World Intellectual Property Organisation (WIPO) Copyright Treaty and the WIPO Performance and Phonograms Treaty*
Source: Standing Committee on Copyright and Related Rights, Tenth Session in 2003 and Sixteenth in 2006

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[10] *"Digital Rights Management and Consumer Acceptability – A Multidisciplinary Discussion of Consumer Concerns and Expectations" by INDICARE, December 2004*

Relevant Copyright Laws by Selected Countries		
WIPO Treaties		Started initiatives for amendment of member countries laws for provisions such as the rights of reproduction, communication to the public and distribution, and prohibits circumvention of technological measures and rights management information.
US	• USA Copyright Act, 1976 • DMCA*, 1998	Digital Millennium Copyright Act (DMCA) implements the WIPO Treaties. DMCA exceeds WIPO Treaties to separately prohibit circumventing acts and products, and with respect to "access control" and "copyright control" technological measures for protecting copyrighted work.
EU	• Copyright Directive 2001/29/EC	In 2001, European Union adopted the Directive on the harmonisation of certain aspects of copyright and related rights in the information society, which implemented the WIPO Treaties provisions. The Copyright Directive is deemed broader than DCMA as it also prohibits acts of circumventing copyright control measures and other acts not authorised by the rights holder. Prior to this, at European Community level, circumvention of technological measures was addressed in three other directives, namely on dealing with legal protection of computer programme, conditional access and electronic commerce.
Japan	• Copyright Law • Unfair Competition Prevention Law	In Japan, the anti-circumvention provision in WIPO Treaties implemented in the 1999 amendments to the Copyright Law (addressed circumvention of technologies protecting against copyright infringement) and the Unfair Competition Prevention Law (addressed prohibition of both circumvention of copy control and access control technological measures). The Copyright Law of Japan defines "circumvention" as the enabling person to "do acts prevented by technological protection measures" (i.e., prevention) or stopping the "obstructions" to the results of acts that are "deterred by such measures" (i.e., deterrence)
Australia	• Copyright Act 1968 • Copyright Amendment Act (Digital Agenda) Act 2000 (DAA)	DAA, which came into effect in 2001, and amended Copyright Act 1968 (that included new Division 2A of Part V) substantially implemented the WIPO Treaties. The Australian approach is reported as more favourable to users that its counterparts in US and EU; reflecting the fact that Australia imports more copyright-related products then its exports. In terms of anti-circumvention provisions, the DAA prohibits the business of trafficking in circumventing tools, including manufacturing, selling, renting, offering for sale, promoting, advertising, marketing, distribution and exhibiting a device. This includes making the circumvention device online (to extent that it affects prejudicially the owner of the copyright). The acts of offering *"circumvention service"* are prohibited under DAA, the same is practised by US and EU counterparts.

www.copyright.gov/legislation/dmca.pdf
Source: Adapted from "Current Developments in the Field of Digital Rights Management", www.wipo.int, November 2003

Exceptions in Copyright Acts

There is much debate still, for example, EU Member States transposing the EU-Copyright Directive (EUCD) into national law. The appropriate design of copyright law is at best still being reviewed for the digital age to satisfy or better serve the interests of all relevant stakeholders, including creators, artists, teachers, students, and the public at large. Nevertheless, most jurisdictions have included into their laws exceptions to use for various user categories falling under "universal access".

Again, the digital scenario offers new forms of interpretations that need to be viewed or reviewed in context.

Exceptions in Copyright Laws – Selected Countries

1. Provisions relating to visually impaired users

- Australia
Statutory scheme to assist people with disabilities first inserted into the Copyright Act by the Copyright Amendment Act 1980. The statutory licence permit multiple copying by institutions assisting persons referred to as "print handicapped".

- The Republic of Korea
The Copyright Law of 1989 (Article 30) as amended provides exceptions in respect of format conversion for the benefit of blind people.

- United Kingdom
The Copyright (Visually Impaired Persons) Act 2002, which came into force on 31 October, 2003, amends the Copyright Designs and Patents Act 1988.

- United States of America
An act of Congress in 1931 established the National Library Service (NLS) for the Blind and Physically Handicapped, Library of Congress that administers free national library programme of reading materials for visually handicapped adults. The programme was expanded in 1952 to include blind children; in 1962 to include music materials; and in 1966 to include individuals with physical impairments that prevent the reading of standard print.

2. Provisions relating to distance education

- Australia
The Copyright Act of Australia (Parts VA and VB) has provisions that allow educational institutions to use copyright material for educational purposes without needing permission from the copyright owner, including both limitations and compulsory licence mechanisms.

- The Republic of Korea
The Copyright Law of 1989 (Article 23) as amended provides for certain exceptions in relation to education.

- United Kingdom
European Union Copyright Directive (Recital 14) expressly recognises the need for certain exceptions in the public interest for the purposes of education and teaching.

- United States of America
Prior to 2001 and the enactment of the Technology, Education, and Copyright Harmonsation Act (TEACH Act), exceptions to copyright under the United States Copyright Law in respect of educational uses were those derived from the "fair use" provision in Section 107, and those introduced into the Law by the 1976 Instructional Broadcast Copyright Act Exemption.

Source: "Automated Rights Management Systems and Copyright Limitations and Exceptions", www.wipo.int, May 2006

Another example is the Malaysian Copyright Act, 1987, that has several specific provisions[11] as follows:

a. Non-profit research, private study, criticism, review or the reporting of current events, subject to various conditions;
b. Educational purposes such inclusion of a work in a broadcast for illustration for teaching purpose or the setting of exam questions;
c. Any use by public library which is for purposes of public interest; and
d. The making of quotation from a published work is allowed as long as compatible with fair practice such as stating source. The same goes for reproduction of articles published in the newspapers.

Concept of Fair Use

"Fair Use is a principle of copyright law in most parts of the world, though it does not usually go by that name outside the US. Under specific conditions, it explicitly allows copying of copyrighted goods, such as quoting a book in a review, or making a copy of an audio recording for personal domestic use. Unfortunately, the line between legitimate fair use and piracy is usually a matter of user intent, which no technology can determine. As a result, content protection technologies cannot, even in principle, exactly preserve the current notion of Fair Use and still offer robust content protection. Most likely, the technology capability will evolve and the practical definition of "fair use" will also evolve, to some middle ground acceptable to consumers and copyright holders[12]."

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[11] *"Digital Technology, Copyright and Education the Malaysian Perspective", www.bileta.ac.uk, April 2000*
[12] *Info-mech DRM_dictionary website*

DRM Emphasis in the EU

In Europe, there have been many initiatives over the past two decades, focusing on the deployment and development of DRM systems to facilitate the management of intellectual property rights for digital assets. As in the case when DRM systems were first introduced to currently, the topic of digital content management including DRM is high on the European Commission's agenda. These not only concern initiatives aimed at adapting legal measures to protect DRM as the basis for many new services and products earlier in the DRM development, but today, calling for the use of DRM to be interoperable.

The European Commission (EC) recognises the importance of DRM availability for new business models to develop in the broadband market. DRM systems and services are a key component of the e-Content distribution. Likely issues deserve attention at an early stage of commercial implementation; amongst these issues, the interoperability of DRM remains to be addressed together with concerns of stakeholders or consumers such as privacy concerns. Towards this end, the EC established a High Level Group to address issues arising from DRM in 2004.

The advent of broadband networks and their capacity to transmit large volumes of multimedia content at high speeds emphasise the importance of ensuring that digital content is available under the appropriate conditions, which meet the interests of all stakeholders. In this context, DRM technologies are promising to establish the right incentives for this development, notably a secure environment for ensuring remuneration of right holders in the context of private copy, payment for online content as well as preventing illegal copying.

In the European Union Development Plan, i2010 Mid-Term Review, one of the actions identified for 2008-2009 is "to address issues concerning the interoperability and transparency of DRM systems for consumers in the Recommendation for Content Online" in the long term policy agenda for users in the digital environment. Article 6 in the European Copyright Directive protects DRM systems from circumvention.

The European Commission also supports a number of projects to refine DRM technologies as follows:

European Projects on DRM		
Programme	**Project**	**Objective**
2nd Framework Programme (1987-1991)	CITED (Dec 1990-Dec 1992)	To safeguard copyright material stored and transmitted in digital form
3rd Framework Programme (1990-1994)	COPICAT (Dec 1993-Mar 1996)	To develop a generic architectural model for an "electronic copyright protection system". COPYCAT extended the CITED project copyright-related event management model to include a security model appropriate to the application domain.
4th Framework Programme (1994-1998)	IMPRIMATUR (Dec 1995-Feb 1999)	To establish a study on the challenges of multimedia rights clearance in networks, that is, investigating how an agreement on trade in electric versions of creative works could be reached and what role DRM systems could play in this context.
	COPEARMS (Nov 1995-Oct 1998)	To work with other European Commission projects concerned with IPR management, by supporting development and implementation of an interoperable Electronic Copyright Management System (EMCS) and by co-operating in a standardisation process necessary to permit interoperability among different ECMS.
	COPYSMART (Dec 1995-Feb 1999)	To develop an industrial low-cost solution for implementing IPR management based on earlier CITED model.
	ARGOS (May 1998-Apr 2000)	To ensure the effective management of IPR for all parties involved in the field of electronic commerce, including secure transmission and access.
	FILIGRANE (Sep 1998-Aug 2000)	To develop building blocks of management system, particularly for protection of authors' rights and piracy prevention.
	E-CCLUSTER (Oct 1998-Sep 1999)	To promote the progress of the electronic commerce of intangible goods with which rights were associated; focused on operation of interoperable systems (for protection of information against piracy and for secure payment) and promotion of IPR management systems.

European Projects on DRM (continued)		
Programme	**Project**	**Objective**
5th Framework Programme (1998-2002)	CREA Net (Jan 2000-Sep 2002)	To create a secure environment for authors and producers; allowing them to collaborate in the pre-development and development business stages; co-production and worldwide pre-sale regarding European film titles, TV programmes and media rich interactive works through a local network (CREA Net) of local centres
	OCCAMM (Jan 2000-Dec 2001)	To develop and ultilise interoperable enabling tools and components for the controlled access, delivery and consumption of multimedia information over networks (for example by prototype applications)
	RIGHTSWATCH (Jan 2001-Dec 2002)	To look at the development of a self-regulatory procedure to deal with problems associated with copyright on the Internet.
6th Framework Programme (2002-2006)	INTEROP (Nov 2003-Nov 2006)	To set up as a *"network of excellence"* aimed to create the conditions of an innovative and competitive research in the domain of interoperability for enterprise applications and software. One of the interests was the standardisation of DRM.
e-Content Programme	INDICARE (Mar 2004-Mar 2006)	To support development of European cultural and linguistic multimedia content for the Internet: Aimed at facilitating access to the Internet for all. To raise awareness and support the emergence of a common European position with regard to consumer and user issues of DRM solutions.
i2010 Mid-Term Review	2008-2009	One of the objectives under the long-term policy agenda for users in the digital environment is address issues concerning the interoperability and transparency of Digital Rights Management systems (DRMs) for consumers in the Recommendation on Content Online

Note: Acronyms for the various projects are best referred to from the source cited below
Source: Adapted from "Digital Rights Management and Consumer Acceptability – A Multi-Disciplinary Discussion of Consumer Concerns and Expectations", www.indicare.org, December 2004

DRM AND ITS IMPLEMENTATION

Alternative Business Models

While it is noted that DRM has heavy buy-in especially for large scale commercial piracy[13], it can be noted that DRM exists alongside legacy or alternative business models that do not employ DRM such as open licensing schemes; sponsorship and advertising; promotion activities; syndication and levies.

Business Models not Using DRM to Monetise Content Offerings	
Business Models	**Description / Usage**
Open licensing schemes	These are password-based subscriptions where restriction of use is pre-determined by a contract and consequent password authentication of the user.
Sponsorship and advertising	The concept of using content given for free in exchange for the access to digital content offerings being paid for through advertising and sponsorship is a traditionally common method.
Promotion activities	Content used as a sample of offerings to promote mainstream content such as clips on mobile TV to entice viewers to watch the whole programme on broadcast TV. New media channels such as the Internet can provide a special platform for new artists to offer free music downloads or offer free downloads. Content can also be offered free to allow users to sample before buying or content is offered free or at lower cost to promote purchase of a product or service.
Syndication	Syndicating content is where content creators sell online content to other providers such as portals, ISPs, telecom service providers, whilst the latter make these content available at a discounted rate or free of charge in exchange for using the primary services provided. Such content is a value-added component for marketing purposes.
Levies	Usually for compensation for copyright exemptions like private copying, bot for compensation of copies distributed over digital networks. Levies can be imposed on storage media, recording equipment and copying devices and hardware.

Source: Adapted from "Digital Rights Management and Consumer Acceptability – A Multi-Disciplinary Discussion of Consumer Concerns and Expectations", www.indicare.org, December 2004

Nevertheless, as the digital content environment increasingly becomes more widespread and ubiquitous, there are anticipated changes in the dynamism of the use of these alternatives business models versus DRM systems. For example, the ongoing debate in Europe of the need to legally do away with levies as DRM systems get more entrenched because the two in existence into the future tends to create a technical "loophole" where consumers could double pay for "rights to use" in the process of the digital content en route to them.

No doubt there are many types of business models to monetise content and control usage rights, but these need to be used within appropriate context after weighing the costs and benefits.

Ideal DRM Implementation

As with any technology that is implemented, each of it has its own strength and weaknesses. In the case of DRM and its implementation, all actions in terms of rights management need to satisfy all parties involved from the end user to the rights holders end.

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[13] "Digital Rights Management and Consumer Acceptability – A Multi-Disciplinary Discussion of Consumer Concerns and Expectations", www.indicare.org, December 2004

Ideal DRM Implementation

- Reflect a content owner's intentions
- Simple (ease-of-use) or transparent to consumers
- Standardised DRM rules for all different DRM systems
- Scalable solution with devices and cost-effective
- Processes support devices (in terms of robustness and renewal) with varying levels of security
- Many acceptable DRM standards
- Overly restrictive content usage rules
- Consumer backlash, due to the above

Source: Adapted from "Digital Rights Management for Seamless Mobility (Broadband World forum-Asia)", www.motorola.com; "Beyond Traditional DRM: Moving to Digital Watermarking & Fingerprinting in Media" by MMI, 2008

DRM Challenges

Since digital data security is not confined to the computer which holds the data or even behind firewalls, DRM is likely to face significant challenges of not only encrypting data but also to define control mechanism to control actions of how users use the data. Some of those challenges along these lines could be as follows:

DRM Challenges

- Manage, track and enforce usage rules
- Manage and enforce the trust relationship between DRM agent and media applications/decoders owners
- Manage and protect local data, local secrets and other data that needs protection against unauthorised access
- Localisation, protecting against attacks involving unauthorised transfer of information between devices
- Code obfuscation protecting against reverse engineering
- Ability to utilise and take advantage of features of a secure platform

Source: Adapted from various sources

CONCLUSION

As digital content can be faultlessly replicated and distributed widely, content owners consistently search for means to employ a suitable protection mechanism available in order to prevent the possible abuse of their copyrighted materials. Significantly, DRM provides various enhanced "control" over the ability of the user to make use of copyrighted works compared to the old IT control mechanisms.

Across all countries, many efforts and measures have been made to ensure such content creator or distributor rights in copyrighted or copyrightable materials are effectively protected. This is due to piracy in this digital era as web services become one of relatively easy and more widely available channels to download many types of content in a digital format over broadcast, wireless and wired modes. Hence, this progress towards a converging multimedia environment also drives the need to have specific technologies which can accommodate the functionality for protecting rights for use of content in a digital form.

So far, although DRM assists to remedy the need for digital content management, the system does have existing system shortcomings. Therefore, the constant efforts and cooperation among DRM working groups and DRM vendors globally in tackling issues of DRM-based business models and systems can be viewed as an ongoing affair in a continually converging digital environment.

Overall, considerations are in the areas of accommodating security, customer-relations, legal reasons and economic benefits to all parties in the DRM value chain. Ultimately, not only is it a win-win solution for loyal consumers who will benefit from lower content costs, abundant supply of premium content, and a true 'anywhere, anytime' consumption experience, but it also offers DRM vendors and content owners incremental and sustainable revenue generated by efficient content distribution through digital platforms.

A Word of Caution

"The use of digital rights management is controversial. Advocates argue it is necessary for copyright holders to prevent unauthorised duplication of their work to ensure continued revenue streams. Opponents, such as the Free Software Foundation, maintain that the use of the word "rights" is misleading and suggest that people instead use the term Digital Restrictions Management. Their position is essentially that copyright holders are attempting to restrict use of copyrighted material in ways not covered by existing laws. The Electronic Frontier Foundation, and other opponents, also consider DRM systems to be anti-competitive practices. The term Digital Rights Management has been used by opponents as well.

In practice, all widely-used DRM systems have been defeated or circumvented when deployed to enough customers. Restricting copying of audio and visual material is especially difficult due to the existence of the analogue hole, and there are even suggestions that effective DRM is logically impossible for this reason[14]".

All said, the approach of DRM appears to satisfy to some extent various parties' requirements. Nevertheless, this approach does require applications to be used in careful consideration of its limits and benefits to content usage from the perspective of the consumer, suppliers, service providers including special interest group such as creative commons movement and other such initiatives or parties.

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[14] www.wikipedia.org

ACRONYMS

AAC	Advanced Audio Coding
AACS	Advanced Access Content System
ATSC	Advanced Television Systems Committee
BD	Blu-ray Disc
BMG	Bertelsmann Music Group
CA	Conditional Access
CAGR	Compound Annual Growth Rate
CD	Compact Disc
CD-R	Compact Disc-Recordable
CGMS	Copy Generation Management System
CPRM	Content Protection for Recordable System
CSS	Content Scrambling System
DAA	Digital Agenda Amendment
DAB	Digital Audio Broadcasting
DMB	Digital Multimedia Broadcasting
DMCA	Digital Millennium Copyright Act
DSL	Digital Subscriber Line
DTH	Direct-To-Home
DTCP	Digital Transmission Copy Protection
DVB	Digital Video Broadcasting
DVB-H	Digital Video Broadcasting - Handheld
DVD-R	Digital Versatile Disc-Recordable
DWM	Digital Watermarking
E-Commerce	Electronic Commerce
EDiMA	European Digital Media Association
ECMS	Electronic Copyright Management System
FTP	File Transfer Protocol
HD	High-Definition
HDCP	High Bandwidth Digital Copy Protection
HDMI	High-Definition Multimedia Interface
HEN	Home Enterprise Network
IFPI	International Federation of the Phonographic Industry
INDICARE	Informed Dialogue about Consumer Acceptability of DRM Solutions in Europe
IRC	International Relay Chat
ISDB	Integrated Services Digital Broadcasting
ISWC	International Standard musical Work Code
IP	Internet Protocol
IPTV	Internet Protocol Television
LAN	Local Area Network
MMI	MultiMedia Intelligence
MPEG	Moving Picture Expert Group
OMA	Open Mobile Alliance
PDA	Personal Drive Assistant
PDF	Portable Document Format (Adobe Acrobat)
PET	Privacy Enhancing Technologies
P2P	Peer-to-peer
RIAA	Recording Industry Association of America
REL	Rights Expression Languages
SSL	Secure Sockets Layer
STB	Set-Top Box
UGC	User Generated Content
URI	Uniform Resource Identifier
VoD	Video on demand
WIPO	World Intellectual Property Organization
WM	Watermarking
WMV	Window Media Video
XCP	Extended Copy Protection

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