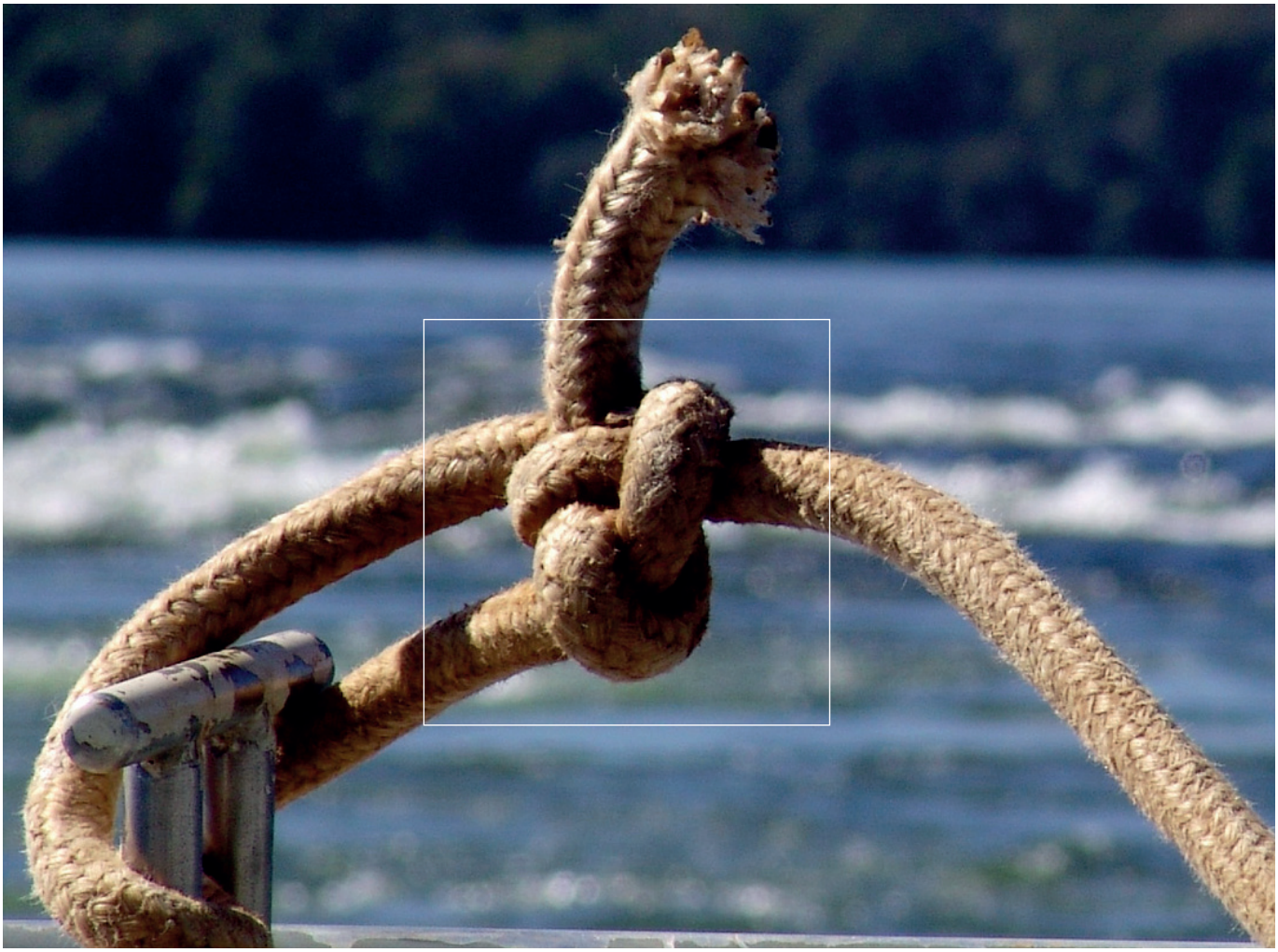
Arthur D Little

Telecommunication, Information,
Media & Electronics

Untying the Gordian Knot

Digital Rights Management – Untying the Gordian Content Knot



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Executive Summary

Digital Rights Management (DRM) has evolved as a means to protect the interests of content owners and aggregators to stop (or at least reduce) piracy. However, today's DRM systems do not sufficiently incorporate the needs of end users and other key stakeholder groups along the digital media distribution value chain.

Going forward, we see three possible scenarios for DRM:

1. Continued fragmentation of proprietary DRM systems and continued limited fulfillment of stakeholders' needs and requirements (Continuation of today's situation)
2. Gradual abandonment of DRM in favor of other content tracking techniques such as "watermarking" or "fingerprinting"
3. Emergence of one or several next generation DRM system(s) that manage to balance end user needs for ease of use, privacy protection etc. with the needs of all other stakeholders

From an end user perspective as well as other key stakeholder groups along the value chain, Scenario 3 above is the scenario that best encompasses the needs of all stakeholder groups.

It is unlikely that we will see the emergence of successful next generation DRM systems that satisfy key stakeholder needs without:

- The joint efforts of industry actors throughout the value chain
- Necessary revision of copyright legislation by regulators to provide clear incentives to the industry to develop next generation DRM systems
- DRM systems built on an interoperable set of proprietary standards or DRM technologies that are based on open industry-wide standards

Should this fail, all stakeholder groups may be better off with no DRM (Scenario 2) rather than a series of lopsided variants (Scenario 1).

Introduction

The media debate regarding DRM the past few years has pitted two groups against each other: End users accused of wanting a free lunch (e.g., through file sharing) and content owners who sometimes have been overambitious in building fences around their rights.

This paper firstly provides an introduction to the concept of DRM. It then identifies needs of end users and other stakeholder groups and analyzes how well today's DRM systems fulfill these needs. The paper then analyzes legal and regulatory perspectives around DRM before drawing conclusions on which end game for DRM would be most beneficial for end users as well as other key stakeholder groups along the value chain.

The conclusions in this paper are the result of both primary and secondary sources. Primary sources include interviews with DRM experts, industry actors and regulatory expertise. Secondary sources are a large set of business articles and academic reports as well as internal Arthur D. Little data bases.

What is Digital Rights Management (DRM)?

Protecting service revenue streams is and has long been a top priority for content owners, aggregators and distributors along the TV broadcast value chain. The predominant way of securing service revenues has historically been conditional access (CA) mechanisms, whose aim is to restrict access, through technical means only, to those that have paid for the service. The main way of implementing this is through scrambling algorithms (mainly DVB-CSA) and entitlement handling on a per channel or channel group basis.

Conditional access (CA) is a term that has been around since the early 1990s and is well established in the TV world. However, as the digital era has changed the way we consume content, a new term has evolved – Digital Rights Management (DRM).

Today, DRM is used as a generic term for access control technologies used by content owners and hardware manufacturers to control the access of digital content to end users. The DRM term is also closely related to content tracking systems such as "watermarking" or "fingerprinting", which link protected content to individual consumers as a way to detect and act on prospective copyright infringements.

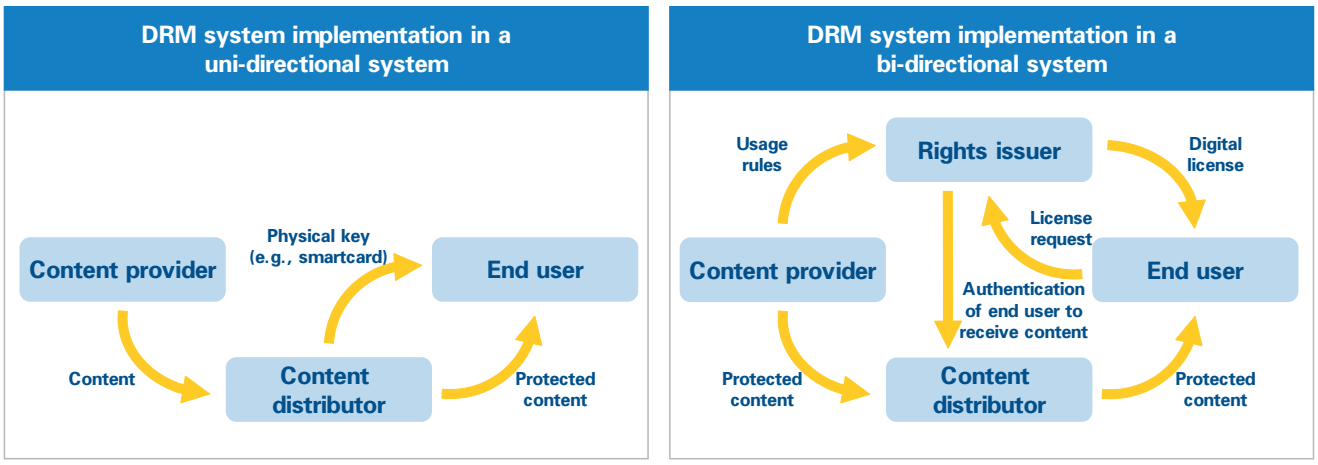
The ultimate aim of DRM systems is content protection – to prevent unauthorized access, duplication or conversion to other formats by individuals and thus protect the interests of copyright holders and publishers. However, alongside basic content protection, DRM systems are designed for other strategic purposes by players in the value chain, such as:

- Enable new content business models (e.g., Spotify or Voddler)
- Track content usage (e.g., to enable individually targeted advertising or reward super-distribution among users)
- Lock consumers into specific technology platforms (e.g., Apple's iTunes)

DRM systems are implemented both in physical media, uni-directional broadcasting services and bi-directional solutions. Examples include:

- CDs or DVDs with electronic copy protection
- Traditional TV with conditional access
- Online services for purchasing and downloading protected content (e.g., iTunes, Amazon.com, CDON.com)
- Video on demand services (VoD)

Figure 1. Simplified illustration of generic DRM implementations



Source: Arthur D. Little analysis

In uni-directional broadcasting services, such as traditional TV, the content is broadcast to everyone but only made accessible to those who have a valid physical key for authenticating end user access (e.g., a smart card).

DRM implementations in bi-directional systems rely on a setting where any capable device must perform a real time service access authentication/notification to the transmitting side through a back channel before getting access to the content. The process is centrally managed through a "rights issuer", which manages license rights and authentication. Figure 1 illustrates the principles of generic uni-directional and bi-directional DRM system implementations.

Although significant progress has been made in developing and improving DRM solutions, DRM still has a dubious reputation among end users due to insufficient performance in key aspects such as interoperability, ease of use and privacy protection. Furthermore, for system and device manufactures as well as for content distributors, DRM systems have proven to be anything but a smooth, low cost and low friction means of spreading content.

The DRM Challenges – Balancing Stakeholder Needs

While securing the interests of content owners and aggregators, next generation DRM systems need also to harmonize with other stakeholder needs along the digital media distribution value chain. The different stakeholder groups pose various requirements on a successful DRM system as illustrated by figure 2 below.

There is currently a wide array of DRM solutions on the market, fulfilling the needs of various situations and various stakeholder groups. A handful of competing systems have been listed in figure 3 . One relevant question to ask is: How well are these DRM systems fulfilling all the stakeholder needs?

Figure 2. Stakeholder requirements on a DRM system

	Content owners and aggregators	System and device manufacturers	Content and information distributors	End users
Key stakeholder groups	■ Music companies ■ TV channels ■ Video on demand providers	■ Manufacturers of: – TVs – Servers – Mobile devices	■ Network operators	■ Private persons ■ Enterprises
Examples of players	■ Disney ■ Sony ■ TV broadcasters ■ Warner Bros ■ Etc.	■ Philips ■ Nokia ■ IBM ■ Tandberg/ Ericsson ■ Etc.	■ AT&T ■ British Telecom ■ Deutsche Telekom ■ TeliaSonera ■ Etc.	■ You ■ Your family ■ Your friends ■ Your working place ■ Etc.
Requirements of a DRM system	■ Maximization of content revenues ■ Reliable and leak proof rights protection ■ Leakage tracing	■ Interoperable regardless of hardware ■ Low cost and complexity ■ User friendliness (to avoid user churn to other devices)	■ Compliance with content owners' requirements ■ Support for different business models ■ Hassle free distribution ■ Low cost	■ Low cost for acquiring content ■ Ease of use ■ "Plug & play" ■ Privacy protection ■ Unfettered personal use across platforms ■ Not locked in to specific digital store or service provider ■ Unrestricted use for family members

Source: Arthur D. Little analysis

Figure 3. Overview of a sample of DRM systems and initiatives

Overview of a sample of DRM systems and initiatives				
Manufacturer	**DRM solution**	**Open / proprietary standard**	**Interoperability between several devices**	**Comments**
Microsoft	**PlayReady**	Proprietary	Interoperable to a certain extent, but not interoperable with e.g., Apple devices	■ Microsoft's proprietary DRM system primarily aimed for mobile devices ■ Supports a range of hardware environments and operating systems
Apple	**Fairplay**	Proprietary	Limited to users of Apple devices	■ Relatively simplistic proprietary DRM technology originally developed by Veridisc ■ Fairplay encoded content is purchased from the online iTunes store ■ Apple abandoned DRM on music content in 2009 (video content is still DRM encoded)
MDC	**Marlin**	Open	Interoperable across technology platforms	■ Content sharing technology platform created by an open-standards community initiative called the Marlin Developer Community (MDC) ■ Formed in 2005 by five companies (Intertrust, Panasonic, Philips, Samsung and Sony) and has today 14 members
Open Mobile Alliance	**OMA DRM**	Open	Interoperable across supported handsets	■ Open standard DRM system aimed specifically for content distribution to mobile handsets ■ So far implemented in around 550 handset models
DECE LLC	**DECE**	Open	Interoperable across technology platforms	■ Digital Entertainment Content Ecosystem – Cross-industry consortium developing a new interoperability framework supporting multiple DRMs (initially 5 DRMs) ■ The technology standard is yet to be released ■ Examples of member organizations are: Alcatel Lucent, Cisco, HP, Intel, Microsoft, Panasonic, Samsung, Sony, Warner Bros

Source: Arthur D. Little analysis

Content owners and aggregators

Content owners and aggregators have a genuine incentive to promote the use of DRM to secure revenues by stopping any non-authorized access to, or redistribution of, content (e.g., upload of stored content or re-streaming of real time content). For this purpose, content owners and aggregators typically require that content distribution services adopt approved digital rights technologies as a condition of granting content licenses along the value chain.

Content owners and aggregators also pose requirements of DRM systems to be able to trace the origin source and receiver of premium content, in case non-authorized redistribution is detected.

Content owners have long relied on uni-directional content protection systems, based on smart cards, for controlling audiovisual content access. Such systems have proven to be vulnerable to pirates and hackers who have implemented widespread illegal codeword sharing systems online. Countermeasures such as "chipset pairing", induced from the content industry, have not been successful in suppressing the skill and cunning of hackers and pirates.

However, DRM content protection has come a long way in recent years, and major advances have been made in terms of security technology. Modern bi-directional DRM systems are particularly sophisticated, with a high level of content protection for content owners and aggregators. Furthermore, the trend towards more content being delivered through managed services over secure networks (e.g., IPTV, DOCSIS 3.0) further reduces the risk of content leakage and reinforces content owners' control as compared to e.g., unsecured OTT (over the top television).

System and device manufacturers

System and device manufacturers generally see DRM as a cost driver which adds complexity to their products and solutions. A next generation DRM system should therefore be designed to minimize cost and complexity, for example by avoiding the need for multiple CA/DRM client implementations, minimizing licensing cost and avoiding the need for unique customization based on service provider or CA/DRM vendor.

Furthermore, system and device manufacturers see interoperability between a set of DRM standards, or an open industry DRM standard as a key requirement, not only for minimizing cost and complexity but also to be able to offer attractive products to end users. A next generation DRM system is thus interoperable between devices, operating systems, media players and between any media service provider. This will allow end users to choose freely technologies and service providers without technical barriers to move content between devices.

System and device manufacturers are supporters of an interoperable and open industry DRM standard that can support a wide array of services. It is not a coincidence that many of the world's leading consumer electronics manufacturers have joined forces in open standard initiatives such as Marlin, OMA and DECE.

The issue for system and device manufacturers is that progress is slow, since established proprietary DRM, optimized at a company level, creates sub-optimization at the DRM industry level.

Content and information distributors

Content and information distributors are interested in creating attractive offers to end users and require a flexible DRM system to support different business models such as "consume all you can eat", "consume once" or "own a copy". Flexibility is also required when end users wish to upgrade their acquired rights from one level to another, such as time-limited use to unlimited rights (such as download to own), and just be charged for the increment. Traditional uni-directional DRM systems typically support subscription based business models only, whereas modern bi-directional systems support a wide array of business models, including:

- Subscription: Enabling access to an entire catalog of content in exchange for a recurring fee
- Purchase: Enabling content for purchase and download
- Pay Per View: Enabling pay-per-view choices
- Rental: Enabling rental scenarios with time-based licenses
- Gifting: Enabling purchasing rights for another user

However, an issue for content and information distributors today is that DRM systems can drive significant license costs, which indirectly affects end users. DRM also adds to the complexity of content distribution. Interoperable or open standards with Intellectual Property Rights arrangements according to FRAND can limit the cost of intellectual property.

FRAND

(Fair, Reasonable And Non-Discriminatory terms) refers to the commitment made by participants in a standard-setting process regarding the terms for out-licensing of standardized technology. By committing to FRAND, contributors to a technical standard become contractually obliged to license their technology to all interested parties on commercially reasonable and consistent terms, thus minimizing the potentially anti-competitive effects of patent "holdup". The concept of "reasonableness" in FRAND involves a significant amount of flexibility as actual license fees are usually determined after a standard has been set, although participants may sometimes commit to ceiling license rates (e.g. as a maximum percentage of product manufacturing costs).

End users

From an end user perspective, a good DRM system is an indiscernible DRM system that does not interfere with legal media consumption patterns, such as device shift, place shift or time shift. Consequently, end users pose a number of requirements of a next generation DRM system.

A next generation DRM system must allow end users to consume content at their own preferred location, on their own preferred device and at their own preferred time. This includes the ability to move content between devices and across technologies seamlessly. End users must also be able to consume different content simultaneously (e.g., watch one TV channel while recording another one in the living room at the same time as the spouse watches a movie in the bedroom).

Furthermore, end users want to avoid being locked in to specific digital stores or service providers. The DRM system must therefore allow users easily to switch service provider or device vendor without losing their content library.

In addition to requirements associated with media consumption patterns, end users are concerned with privacy issues and require an open and transparent DRM privacy policy.

Today's DRM systems are not sufficient in meeting end user requirements in terms of:

- User friendliness
- Interoperability between devices and service providers
- Allowing users to move content freely within the private sphere and hence exercise their statutory right (e.g. fair use or private copy exemption as provided by copyright statute in most countries)

It will be an endless battle for DRM systems to win the hearts and minds of the consumers unless the above requirements are unconditionally met. So far, DRM is generally seen as a "necessary evil" by consumers, who often see piracy not only as the cheapest way but also – and more disturbingly – as the less complicated way to get access to premium content.

Piracy will continue to be a problem until DRM systems prove to be user friendly and uncomplicated as well as support the various usage patterns that consumers take for granted – consuming content anytime, anywhere using any device.

Perhaps counter intuitively, fewer restrictions may lead to decreased piracy. If consumers can purchase content legally in a fast, smooth and hassle free environment they are less likely to bother with illegal alternatives.

The Legal and Regulatory Perspective of DRM

In Europe and US, along with most other major jurisdictions, DRM systems are protected by statute, which typically includes anti-circumvention provisions making it illegal to circumvent or "hack" DRM systems. According to article 6 of the Infosoc directive of EC, the only mandatory prerequisite for the anti-circumvention provision is that DRM systems must be "effective" (i.e. protected by encryption, scrambling or other copy control mechanisms which achieve the protection objective).

In the Infosoc directive, legislators have highlighted the interests of end users in terms of private use exemption and privacy protection, as well as compatibility and interoperability between DRM systems. However, these discussions have not been converted into mandatory provisions in most member states' national copyright statutes. This is one key factor explaining why today's DRM systems do not fully comply with the interests of end consumers and why the progress of creating interoperable or open standards is slow.

Going forward, if policy makers and legislators are serious about advancing the current state of DRM technologies and corresponding business conduct, and if they wish to foster progress towards more effective DRM systems, then revisions of current copyright statutes and directives are needed.

The implementation of revised legal DRM provisions and statutory anti-circumvention protections need to encompass not only technology but also business practices that are compliant with a set of principles:

- DRM systems should be effective in protecting rights holders' interests (existing barrier principle in ex. Infosoc Directive)
- DRM systems should be applied on works and materials that are protected by copyright statute
- DRM systems should be business model neutral (e.g. flexible and support a variety of business models and hence offer a variety of choices for the end-user)
- DRM systems should be technology neutral and allow end users to move legal content between devices and media service providers
- DRM systems should be built on an interoperable set of proprietary standards or consist of DRM technologies that are based on open industry-wide standards, to avoid limitation of competition along the value chain (e.g. locking consumers and stakeholders into specific technology platforms and media service providers)
- DRM systems should not be limiting individuals' statutory right to make legal private copies (e.g. fair-use doctrine or private use exemption)
- DRM systems should include privacy statements and an explicit consent process, allowing end users to control exploitation of private information

It is a delicate task for legislators and policy makers to balance the interests of content owners on one hand with those of consumers on the other. Reviewing the legislation and devoting more focus to consumer choice and the competitive aspects of DRM technologies will be one important way of stimulating the emergence of interoperable and/or open standard DRM systems. This will better address the long term interests of all key stakeholder groups, while at the same time reducing piracy.

The Apple story – Abandonment of DRM on music

Consumer groups and competition authorities, particularly in Europe, have recently raised their voices against overly restrictive rights protection systems that obstruct fundamental consumer rights such as the private copyright exemption and seamless mobility of content between own devices. One of the most noted campaigns took place in 2007 when consumer ombudsmen and campaigning groups in Norway, Finland, France and Germany joined forces in an effort to force iTunes and other digital music stores to use interoperable DRM systems. This campaign was one factor contributing to Apple's decision to remove DRM on music in 2009 and introduce watermarking as means of tracking potential content leakage.

Possible End Games

Mark Twain once famously wrote: "It is difficult to make predictions, especially about the future". This is also true for DRM. However, we can foresee three possible future scenarios for DRM going forward:

1. Continued fragmentation of proprietary DRM systems and continued limited fulfillment of stakeholders' needs and requirements (Continuation of today's situation)
2. Gradual abandonment of DRM in favor of other content tracking techniques such as "watermarking" or "fingerprinting"
3. Emergence of one or several next generation DRM system(s) that manage to balance end user needs for ease of use, privacy protection etc. with the needs of all other stakeholders

Figure 4. Fulfillment of stakeholder group needs per scenario

Fulfillment of stakeholder group needs				
Stakeholder group	Stakeholder group need	Fulfillment of stakeholder group needs per scenario		
		1	2	3
Content owners and aggregators	Maximization of content revenues	✗	✓	✓
	Reliable and leak proof rights protection	✓	✗	✓
	Leakage tracing	(✓)	✓	**No need**
System and device manufacturers	Interoperable regardless of hardware	✗	✓	✓
	Low cost and complexity	✗	✓	✓
	User friendliness (to avoid user churn to other devices)	✗	✓	✓
Content and information distributors	Compliance with content owners' requirements	✓	✗	✓
	Support for different business models	✗	✗	✓
	Hassle free distribution	✗	✓	✓
	Low cost distribution	✗	✓	✓
End users	Low cost for acquiring content	✗	(✓)	✓
	Ease of use	✗	✓	✓
	"Plug & play"	✗	✓	✓
	Privacy protection	✓	✗	✓
	Unfettered personal use across platforms	✗	✓	✓
	Not locked in to specific digital store or service provider	✗	✓	✓
	Unrestricted use for family members	✗	✓	✓

Source: Arthur D. Little analysis

We have seen how today's DRM systems fail to fulfill the needs and requirements of end users and other key stakeholders. If industry stakeholders fail to unite around next generation DRM systems (Scenario 1), we will most likely see a gradual abandonment of DRM (Scenario 2) as seen in the Apple story when Apple decided to abandon DRM on its music sold at iTunes in 2009.

Widespread abandonment of DRM and introduction of watermarking or other content tracking techniques would lead to privacy protection problems for end users. A "privacy nightmare situation" can occur if content owners are able to efficiently hunt down and sue alleged copyright infringers, even if the content has been stolen (copied from the individuals' computer without their knowledge).

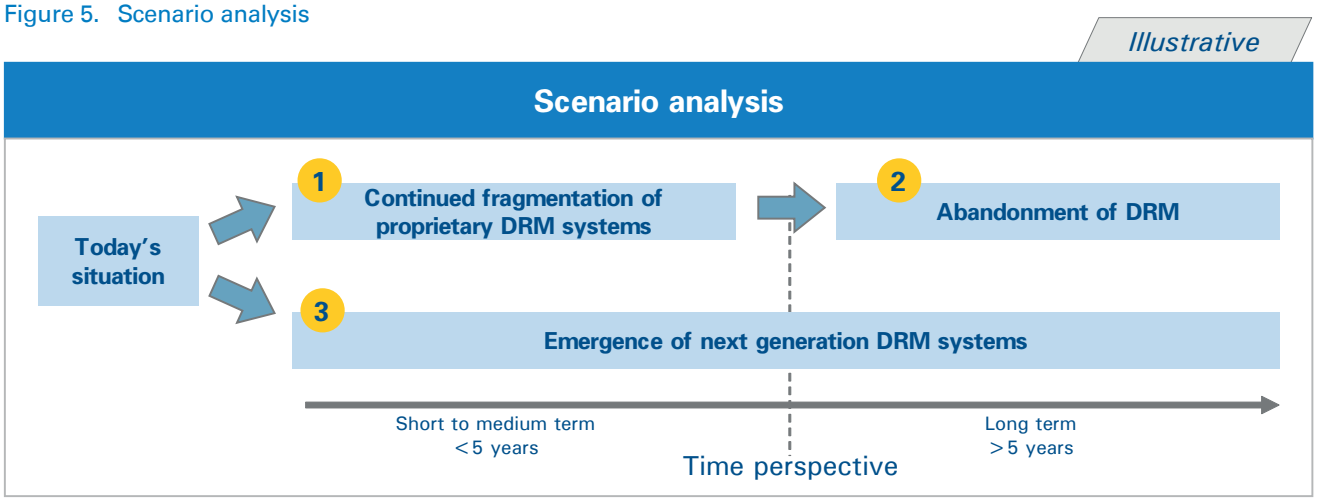
As illustrated by figure 4, the best outcome from the perspective of end users and other stakeholders is the emergence of next generation DRM systems that fulfill needs and requirements regarding rights protection, privacy, ease of use, interoperability, low cost, private use exemption rights and antitrust/ competition concerns (Scenario 3).
For a full review of these principles, see the previous chapter ("The legal and regulatory perspective of DRM").

Such next generation DRM systems will most likely rely on interoperable or open standards such as Marlin, OMA and/ or DECE with commitment from the whole value chain; including content owners and aggregators, system and device manufacturer and content and information distributors.

Legislators and policy makers should continue to provide statutory protections for DRM systems and anti-circumvention but should revise current copyright statutes and directives to balance the needs and requirements of all stakeholder groups throughout the value chain. By doing so, policymakers will give incentives to the industry to devote resources to developing technologies and business conduct towards more effective DRM solutions, for the benefit of end users as well as other key stakeholder groups.

As stakeholders' patience is not unlimited, there is a time window for DRM to fulfill its true potential. Should this fail, a gradual abandonment of DRM will likely be the result as per the "Apple story" and illustrated in figure 5.

Figure 5. Scenario analysis



Source: Arthur D. Little analysis

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The Gordian Knot

The Gordian Knot is a legend of Phrygian Gordium associated with Alexander the Great. It is often used as a metaphor for an intractable problem, solved by a bold stroke ("cutting the Gordian knot").

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