DIGITAL RIGHTS MANAGEMENT

The Museum of Television & Radio
Media Center Dialogue
Briefing Summary

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Foreword

We are delighted to launch a new benefit of MT&R Media Center membership with the publication of our premier Dialogue Briefing Summary, *Digital Rights Management*, which recounts a recent high-level Dialogue entitled *Protecting Digital Content* on the subject of how technology can promote protection of content in the digital age. This is the first of several reports members will receive exploring topics of paramount importance to the media industry.

The Dialogue Series is the signature program of the MT&R Media Center, which brings together the top executives and leading thinkers in the global media industry to discuss a wide range of critical issues that directly impact and define the media and its role in society. Held at the Museum’s locations in New York City and Los Angeles, the topics for these programs are developed with advice from the Media Center’s Board of Governors and moderated by a leader in the field. Approximately twenty carefully chosen individuals, each with experience relating to the area of focus, are asked to participate in each Dialogue. The small size of the group, combined with the participants’ broad range of perspectives and expertise, creates a dynamic roundtable exchange. Major themes are often explored over the course of several sessions so that the complexity of the subject can be thoroughly examined from many angles. Dialogues are designed as a series of evolving conversations that build momentum so that they may contribute to the resolution of significant industry issues.

Digital Rights Management is a particularly appropriate and timely topic for our first report. It is estimated that digital piracy extracts over $3 billion annually in potential worldwide revenues.
It threatens to undermine the global media business, and many media executives consider piracy the most important challenge they are confronting. A truly collaborative, industry-wide effort must be undertaken, not only by content creators but by equipment manufacturers, to stop the tide of digital piracy—without alienating consumers. We invite you to read Rob Frieden’s insightful summary on the following pages and hope that this report will generate additional thinking and possible solutions to this cross-industry crisis.

Over the next several months, we will be sending you additional reports, dealing with topics such as the changing media habits of young consumers. We welcome your thoughts and comments on Digital Rights Management and trust that you will find something relevant to your business interests in our subsequent reports.

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We also would like to thank Bridger Capital LLC for its generosity in sponsoring the Protecting Digital Content Dialogue, from which this summary was created. We appreciate the efforts of Professor Rob Frieden, who merged the participants’ thoughts into one cohesive document. Rene M. Fasco, global knowledge manager, media and entertainment practice, McKinsey & Company; and Eric German, Esq., Mitchell Silberberg & Knupp LLP; also deserve our gratitude for their help in creating the bibliography that follows this summary. Finally, we thank the team who organized this Dialogue: Christy Carpenter, vice president and executive director, MT&R Media Center; Teri Everett, senior vice president, communications, Fox Entertainment Group; Barbara Dixon, vice president and director, The Museum of Television & Radio, Los Angeles; Becky Levikow, development manager, The Museum of Television & Radio; and Jessica Schneider, assistant, MT&R Media Center.
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Introduction

In 2003, the motion picture industry generated nearly four times as much revenue from video delivery than from theatrical exhibition\(^1\). As video delivery grows in importance, the impact of piracy on the film and television industries increases as well. The Motion Picture Association of America (MPAA) and its international counterpart, the Motion Picture Association (MPA), estimate that piracy extracts over $3 billion annually in potential worldwide revenues\(^2\). Industry leaders now consider piracy the single most important challenge they must confront.

The digitization of content, high-speed broadband access, and the proliferation of Digital Video Disc (DVD) burners in computers have turned video piracy into an option for many consumers and created tension between content developers, who stand to lose from piracy, and technology manufacturers, who stand to gain from the sale of products that may facilitate copying.

Rampant video piracy occurs today largely because Digital Rights Management (DRM) strategies used so far to secure digitized content have been uncoordinated and relatively easy to circumvent. The motion picture industry, information technology companies (hardware and software), and consumer electronics manufacturers cannot be expected to develop DRM safeguards that work one hundred percent of the time. There is definitely


room to improve safeguards, however, and to make it more difficult to access and copy content illegally.

As a new generation of high-definition video content display and distribution enters the marketplace, stakeholders are faced with an opportunity to reevaluate and reengineer DRM solutions. With collaboration and forward planning, the motion picture industry and the manufacturers of content display, storage, and distribution equipment have a better shot at limiting piracy losses for new forms of video content. Towards that goal, the Media Center of The Museum of Television & Radio has convened several Dialogues, for the exchange of ideas on how technology can and should promote protection of content in the digital age.

The most recent Media Center Dialogue on content protection was held in May 2004, in Los Angeles. The Dialogue involved technology-focused presentations from senior-level executives of: Philips Consumer Electronics; Apple Computer, Inc.; Microsoft Corporation; and the Hewlett-Packard Company; as well as a broader discussion on anti-piracy strategies involving representatives from major motion picture and television studios, labor unions, and talent agencies.

The main points raised at this Dialogue were:

- Digital music and video formats, high-speed Internet access, and peer-to-peer networking have created easy and widespread opportunities for piracy of valuable intellectual property;
- DRM standards need to protect intellectual property, but also provide consumers with flexibility in the times, places, devices, and formats for accessing lawfully acquired content;
• DRM strategies need to operate within business models that provide compelling value propositions to consumers, thus making readily available piracy opportunities less attractive;

• Newly emerging formats, e.g., High-Definition DVD (HD-DVD), present an important opportunity to implement effective DRM solutions for the next generation of digitized content; and

• Successful DRM technologies and standards that balance the interests of creators and consumers will emerge only through truly collaborative efforts by content developers and information technology/consumer electronics manufacturers.

Background

Digital Piracy

Technological innovations in digitization, high-speed data delivery to homes, and the convergence of content and conduit have contributed to unprecedented access to information, communications, and entertainment. These innovations also have provided nearly unlimited opportunities for piracy as millions of homes and offices have computers equipped with content storage and duplication devices capable of copying valuable intellectual property.

Digitization converts content into readily transmitted, processed, stored, and copied bits that do not degrade in quality over time, even after sequential copying (which would occur with analog media). High-speed data delivery, an increasingly available and affordable alternative to dial-up telephone access, provides a medium for speedy transfer of large data files, including music,
television programs, and motion pictures. The Internet represents the convergence of content and conduit, giving consumers user-friendly, convenient, and inexpensive opportunities to access content without separating the telecommunications component, which involves transmission of bits, from the content itself.

Consumers increasingly look to the Internet and other media as on-demand platforms for anytime, anywhere, personalized access to content. Consumers expect to have unlimited opportunities to access content in a digital, mobile, personal, and virtual context. The technologies that make this flexible access possible blend what used to be discrete industries and markets, providing consumer electronics, information technology, mobile computing, telecommunications, and content.

In this “convergence” environment, consumers recognize that the balance of power has tilted in their favor, to such a degree that empowerment means for some the right to use technology to circumvent attempts to protect intellectual property rights. Most users of peer-to-peer, file-sharing networks would never consider stealing something in the physical world, but they do not consider copyright piracy criminal or even unethical. For these people, it has become easy to ignore the line between the right to change the time, place, and manner of access to already-purchased content, and the pirating of valuable intellectual property.

This blurring of lines has occurred most significantly over the past few years with digital music. When confronted with allegations of theft, many consumers have scoffed at the greediness of Big Media, proclaimed a new right of free access, or justified copying as a response to no available commercial alternatives. Consumers rationalize accessing the Internet to “burn” or “rip” a compact audio disc of a preferred music mix, previously unavailable from copyright holders, as reasonable self-help in light of the
slow movement of record companies away from the “all-or-nothing” album model available in a bricks-and-mortar store.

**The Rise of Consumer Power**

In a digital environment, consumers have grown to expect improved convenience and flexibility when accessing content. “Anytime access” means that consumers are no longer captive to a fixed-in-time, one-way broadcast distribution model. The videocassette recorder first offered “time shifting”; personal video recorders and computer hard disk drives offer improvements to that process. “Anywhere access” means that consumers expect to have tools that make it possible to view content via different devices possibly using different formats. “Space shifting” refers to the ability of consumers to transfer content from one device, for which the content was initially configured, onto another device for ease-of-access, particularly in a mobile environment.

The development of MP3 audio made it possible for consumers to shift previously purchased music on compact discs onto smaller and even more portable players. MP3 availability also provided a compressed digital format for speedy downloading of pirated music and for the formatting of music playlists that record companies did not offer. Widespread acceptance of the diminished audio quality of MP3s showed that, in the music environment, most consumers will trade off quality for cheaper, or even free, access to content.

Time shifting, space shifting, and consumer-created music playlists provide examples of how content access has become personalized and platform-based. Consumers expect to have the freedom to access, configure, and manage their content. They have little tolerance for restrictions imposed by content creators
on access, retransmission, and reformatting. Likewise, they have limited patience for technological limitations on portability, interoperability, and general ease-of-use. Content creators and equipment manufacturers must satisfy these expectations, largely because the marketplace will punish them by rewarding competitors who offer compelling value, or by creating incentives and opportunities for piracy—including equipment lacking any kind of content protection.

**Digital Rights Management (DRM)**

Digital Rights Management (DRM) refers to the use of technology to provide methods for guarding against violations of intellectual property rights, while enabling consumers to access content by specifying and verifying rights that can include conditional opportunities to copy and transfer content. DRM typically uses software that not only encrypts content in ways that block unauthorized access and copying, but also enables secure delivery of content to authorized users. An alternative to encryption involves watermarking and other types of forensic tracking where a pattern of digital bits—inserted into an image, audio, or video file—provides information about the file’s copyright. Unlike printed watermarks on stationery and currency, which are intended to be somewhat visible, digital watermarks provide an invisible safeguard scattered throughout the file in such a way that avoids detection, manipulation, and distortion even after sequential copying.

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3 iPod and iTunes provide an example of the former, where a new business model offers consumers the convenience, price point, and inventory worth payment for legitimate access to content. Foreign-made DVD players, lacking regional copyright protections, provide an example of the latter.
DRM for intellectual property, such as music and motion pictures, can never provide total protection from piracy, because it relies on confidential encryption and other technical standards that may be “cracked” and disclosed. With enough time and fortitude, one or more hackers can find ways to circumvent intellectual property protections. The Internet then provides a broadband medium to share secrets with the rest of the world.

At best, an effective DRM system will help discourage piracy and create barriers to, and disincentives for, unauthorized copying and distribution. The challenge lies in creating a sufficiently flexible and effective DRM system that does not degrade the quality of content, operates simply, and does not represent a “lowest common denominator” solution, offering diluted, ineffective protection.

Music and motion picture content creators so far have failed to establish a copyright protection standard that is anywhere close to the necessary potency. Rampant piracy of music CDs and standard-definition DVDs has generated a diversion of revenues that is significant enough to catch the attention of senior executives. With the “cat already out of the bag” for current content media, stakeholders have increased their resolve, attention, and investment in developing a DRM system that will provide adequate protection against piracy of HD-DVDs.

Crafting Effective DRM Strategies
Balancing Content Protection with Flexible Use

A relatively brief window of opportunity currently exists for all stakeholders to work prospectively on a high-definition-DVD standard that provides robust and effective protection of
intellectual property rights, while also providing consumers with access to simple, portable, interoperable, and reasonably priced content and display devices. The key issue lies in the creation of a DRM system that recognizes the freedoms consumers have grown to expect and accommodates such freedoms, while also providing a means for preventing piracy. DRM requires a highly calibrated balance between meeting consumer expectations and properly rewarding content creators for their efforts.

Such balancing allows consumers to make a single backup copy of a CD or DVD to replace a defective or inoperative “original,” but it does not permit unlimited copying. Equity requires content owners to respect the power of technology to accommodate consumers’ ever-diversifying needs and desires regarding when, where, and how they view content. This means that consumers should not be expected to pay additional fees, or secure a different formatted disk, when they shift viewing between and among “interoperable” television sets, personal video recorders, disk drives, and mobile telephones, for example, whether accessed by wire or wirelessly. On the other hand, consumers should recognize that it is illegal to act as small-scale copyright pirates by making perfect digital copies of music and video available to potentially millions of strangers via peer-to-peer networking.

In an environment where hacking DRM technologies requires only the breaking of one lock to open every door, intellectual property rights protection needs to be secure. Additionally, DRM technologies should operate within well-defined rules that specify what constitutes fair use, i.e., non-infringing uses of content that may involve limited copying.
Working Collaboratively

As mentioned previously, today’s consumers have unprecedented sovereignty and power to extract concessions and accommodations in marketplace transactions related to video content. Failing to accommodate consumer preferences risks a backlash of self-help through expanded piracy, or the refusal to acquire new technologies that consumers deem too restrictive, costly, and inconvenient. Next-generation content recording and playback devices thus need to be developed with an appreciation for consumers’ attitudes, as part of an integrated DRM system that protects content, while allowing the flexibility of use to which consumers have grown accustomed.

Content creators, information technology manufacturers, and consumer electronics suppliers collectively agree that they need to collaborate and create a timely and effective DRM system. The failure to do so would extend rampant piracy into the next generation of high-definition DVD digital storage and display technologies, as well as create disincentives for content creators to embrace the best and latest video display options by licensing access. Collaboration requires equipment manufacturers to reach closure on a secure DRM management standard for storage and video display devices. Content creators also need to agree to a standard for secure access to content recorded on discs. DRM thus requires both content creators and equipment manufacturers to work together as never before.

Agreeing on a Single, High-Definition DVD Format

On the equipment side, manufacturers of next-generation DVD players and recorders need to reach agreement on a single standard for displaying high-definition video content, offer sufficient stor-
age, and provide backward compatibility to standard-definition DVDs. Currently, advocates for two incompatible formats vie for supremacy. Hitachi, LG Electronics, Matsushita Electric Industrial, Pioneer, Philips Electronics, Samsung Electronics, Sharp, Sony and Thomson support the Blu-ray format. Blu-ray Disc recorders offer backward compatibility to most existing DVD formats and their discs have more than five times the capacity of conventional DVDs, but require a different replication process. The Advanced Optical Disc (AOD) Consortium, led by Toshiba and NEC, offers full backward compatibility with all current DVD formats and discs, with about three-to-six times the capacity of conventional DVDs, and makes use of the existing replication processes.

**Using High-Definition Video to Enhance the Consumer Experience**

High-definition video display of motion pictures will further enhance the quality of the images displayed and enhance the viewing experience. In the near term, executives at motion picture studios will have to decide whether and how to license access to motion pictures in a high-definition format. Studios have the greatest leverage for impacting the scope and reach of DRM systems for high-definition display, recording, and storage in the negotiations leading up to such licensing. Having largely failed to achieve any significant degree of protection in music compact discs and in standard-definition DVDs, content producers have an important opportunity—prior to the migration to high-definition discs—to negotiate the creation of a DRM system that helps make hacking, downloading, and pirating more time-consuming and bothersome than legitimate forms of access.
The active cooperation of manufacturers that produce disk drives and consumer electronics devices, such as DVD players and recorders, offers content producers a better chance of developing successful DRM capabilities. Through both education and DRM technology, content producers can seek to emphasize the value in paying for the best available video quality in lieu of cheaper, illegal, and lower-quality options. In the short run, high-quality video products are less vulnerable to piracy due to bandwidth limitations that cause long downloading times, absent compression technologies that cause reduction in video quality. While some consumers may opt for the cheaper, lower-quality option—particularly if it can be downloaded for free—many may consider the trading down in quality not worth the investment in time to download illegal content.

On the other hand, content producers should not ignore the probability that a significant subset of the population may tolerate inferior quality, as has happened with MP3s and the migration to VHS videotape from the technically superior Betamax format. Additionally, affordable technological solutions will resolve limitations on bandwidth and disk drive capacity, and will allow users to break down a movie download into smaller increments. Likewise, innovators will find a way to provide seamless connections between personal computers, which receive a video download, and television sets that will provide the preferred video display.

**Devising Compelling Business Models**

A compelling business model offering an attractive value proposition for the consumer provides the “carrot” that can work in tandem with the “stick” of more aggressive intellectual property rights enforcement through litigation. Stakeholders need to de-
vise commercially viable strategies that offer convenience, choice, legality, and value as an alternative to a time-consuming, risky, illegal, and bothersome endeavor. Content producers can devise business models that make DVD burners and readers as something akin to a home box office. Most consumers will respond favorably to the opportunity to view films in a superior video format, just as they would welcome digital projectors in theaters, which would offer cleaner and sharper displays than those commonly experienced by moviegoers.

A compelling business model requires general consensus on what content creators expect content display manufacturers to provide by way of DRM systems and copyright safeguards. The technologies used for DRM need to identify what rights of access consumers have to content and how much flexibility they have in consumption of that content in terms of time, place, and manner—time shifting, space shifting, format conversions, copying, and delivery to more than one display device. Content producers might offer different price points as a function of how many display options and viewings a consumer seeks. For example, music distributors offer a subscription model for “tethered access,” i.e., delivery of content to one or more personal computers, but not to portable storage devices such as hard disks and memory cards.

A compelling business model also requires both content creators and equipment manufacturers to remain sensitive to a consumer’s sense of fair play. Too aggressive a DRM strategy may trigger consumer backlash against both Big Media and the equipment manufacturers who are perceived as “selling out” to these companies. This perception likely will occur if DRM systems interfere with, or trigger the perception of, new limitations on private, non-infringing uses of devices to make copies. Making it “easy for people to do the right thing” and “harder to do the
wrong thing” in a simple and user-friendly manner at a reason-
able price can help deflate emotional claims of price gouging and
market manipulation.

Motion picture producers already appreciate the wisdom of
providing an enhanced value proposition to consumers and have
developed many different pricing models. A movie DVD today
may cost less than the music soundtrack on CD. Movie DVDs
also frequently offer additional features that provide consumers
with added value, such as interviews with the director or actors.
Similarly, motion picture viewing options are available through
numerous “windows” that are offered at various times and dif-
ferent prices in the release schedule—e.g., theatrical exhibition,
pay-per-view, home video, cable, and broadcast television.

Unresolved Issues/Challenges

Various DRM stakeholders have not fully coordinated on issues of
shared importance. Reasons for the lack of cooperation vary, but
they appear to highlight different perspectives. Likewise, the lack
of consensus on effective DRM standards may show the extreme
sensitivity on the part of information technology and consumer
electronics manufacturers that nothing in their accommodation
of intellectual property rights protection will trigger a consumer
backlash. Speaking with one voice on DRM issues requires vari-
ous companies to consider industry-wide interests, sometimes at
the expense of individual company goals.

Achieving an effective and robust DRM system will require
all parties to cooperate and refrain from diluting standards to a
lowest common denominator. Cooperation requires equipment
manufacturers to recognize the mutual benefit in constructing
digital storage, reading, and writing devices that respect intellec-
tual property rights. Failing to acknowledge the need to protect intellectual property may trigger slower content licensing and, in turn, slower market penetration of new devices. Cooperation also requires interested parties to agree on a minimum effective degree of copyright protection. Diluting standards to achieve consensus simply makes it easier to hack the agreed-to DRM program.

The Way Forward

P
articipants at the Dialogue agreed that senior-level executives should continue to meet with a near-term objective of reaching agreement on DRM policies, including a single standard for high-definition DVDs that will contain robust and secure copyright protection. They also agreed that an enhanced consumer education campaign could improve the odds that the public will respect intellectual property rights and not view the issue in terms of Big Media versus the consuming public.

Most participants rejected the view that content creators, such as the motion picture studios, should refrain from licensing the creation of high-definition video DVDs unless or until equipment manufacturers implement a robust DRM system. The information technology and consumer electronics industries want to expedite the introduction of new technologies that will stimulate sales. Moreover, as was the case with VCRs, next-generation, high-definition video devices will provide better quality options for non-infringing private uses. A moratorium on access to high-definition video content—despite the availability of next-generation video players—may trigger consumer resentment: at Big Media’s attempt to stifle innovation and personal expression, and at the acquiescence of equipment manufacturers.
The participants also noted that time is running short for prospectively achieving a uniform, robust DRM system in high-definition video recording, storage, and playback devices. With the commercial debut of HD-DVDs not far off, content creators cannot afford to rely on short-term impediments, such as the difficulty in moving content stored on a personal computer to a television set, or data speed limits on current cable modem and digital subscriber line services.

With the migration from analog to digital services and the convergence of technologies and markets, consumers have increasing control and opportunity to evade restrictions on content access, and use. The “democratization of content” is shifting power from content creators to content consumers. Concerns about who pays and who receives patent royalties for recording and playback devices arguably may pale in comparison to first-mover and lowest-cost-producer advantages, particularly if manufacturers outside the United States decide to offer equipment lacking effective copyright protection. Because so many marketplace developments occur “below the radar screen,” there is no single precipitating event, such as Napster’s debut in the online music world, to galvanize action.

Most participants agreed that studios and other content producers simply cannot leave it to equipment manufacturers to resolve DRM issues. Copyright protection has become a multi-billion dollar annual revenue drain and the single most important issue for content creators, who belatedly appreciate the stakes. All must work cooperatively to ensure comprehensive DRM solutions for emerging formats such as HD-DVDs.
Glossary

Digital Rights
With notable exceptions discussed below, copyright holders have the lawful right to prohibit the unauthorized public performance and distribution of their content. This ownership right extends to derivative uses of the content, e.g., the development of a movie based on a book. Direct infringement occurs when one copies and performs or republishes content without permission. Contributory infringement extends liability to third parties that have facilitated and benefited from the copying, and had the ability to prevent it. The courts determined that Napster so facilitated copying of music that it engaged in contributory infringement, even though it did not make the illegal copies. Vicarious liability occurs when someone financially benefited from copying and knew, or should have known, that the copying occurred, e.g., a night club operator who sells beverages and charges for access to performances of copyrighted music.

Time Shifting
Consumers of intellectual property in the form of music and video typically secure access to content on a one-time, e.g., broadcast or pay-per-view, basis, or on a recorded medium such as a DVD or CD that permits unlimited private consumption. Copyright law typically limits the options available to consumers to duplicate and distribute the content. Consumers generally do not violate copyright law when they record content for later private use. For example, VCR users do not infringe copyrights when they record broadcast tele-
vised content, since this was held to be an exempt fair use by the United States Supreme Court.

Place and Format Shifting
Digital technologies make it far easier for consumers to record content on one device, using one type of format, and to reformat and rerecord the content on another device. For example, many people “rip” music from a CD and store it on their personal computers. Once stored on a hard drive, the content can shift in format to one readily accessed by small devices that have flash memory or a hard drive available to store and display the content. Compression technologies, such as the MP3 standard, make it possible to store music—even video—using less memory or hard drive capacity.

Place and format shifting may trigger intellectual property rights violations, because reformatting and shifting content onto different devices make it possible to duplicate near-perfect copies of the content in a format readily available for unlimited sharing. On the other hand, consumers have legitimate expectations that when they buy content in one format (e.g., a CD), they can reformat the content for use on other devices (e.g., a portable hard drive). Currently, wireless digital home distribution technologies make it possible for a television set to display content stored on a personal computer. A DRM system might permit a consumer to display content contained on a DVD via both devices, while preventing duplication of the DVD or the sharing of the content stored on the DVD with others.
Fair Use

Fair use refers to situations where the copying and display of copyrighted material does not trigger civil liability or constitute a crime, because intellectual property law balances the interests of copyright owners with broader societal interest in widespread access to and dissemination of knowledge. In many instances, progress in science and technology occurs when someone builds from the works of others. Likewise, society benefits when one can criticize, lampoon, and satirize existing work even when copying and performing portions of previous works.

Whether a fair use exemption exists for copying depends on four elements: 1) the purpose and character of the use; 2) the nature of the copyrighted work; 3) the amount and substantiality of the portion used; and 4) the effect of the use on the potential market for the work. For example, a one-time academic use of a small portion of a book would support a fair use finding, while sharing an MP3 music file via a peer-to-peer network with possibly millions of strangers would not.

“Sneaker” and Peer-to-Peer Networking

The need for a more robust and effective DRM system for audio and video content arose when entrepreneurs, music enthusiasts, and software engineers collectively developed a way to use the Internet as a medium for sharing files containing valuable intellectual property. Peer-to-peer (“P2P”) networking refers to the ability of an Internet user to access and download files housed in another Internet user’s personal computer. Initially, P2P networking required an intermediary, such as Napster, to facilitate access, but subsequent
software innovations now permit direct access between two peers—the one accessing content and the one providing the content. Because much of the content shared is protected by copyright, unlimited sharing without consent of the copyright holder violates the law.

Sneaker networking refers to non-Internet mediated copying and sharing of content. Without using the Internet, such sharing does not extend widely and typically involves friends, family, and acquaintances. Such sharing may very well exceed permissible fair use, however.

**Encryption**

With digitization and the increased risk of piracy, intellectual property rights owners have resorted to more sophisticated and less easily circumvented technological safeguards. Encryption refers to the use of a coding mathematical procedure, known as an **algorithm**, which obscures content and makes it more likely that decoding can occur only by authorized users. The encryption process converts information from its normal, comprehensible form into an obscured string of bits, known as **ciphertext**. These bits are unreadable without special knowledge in the form of a “key” or other means to authenticate the right of access by successfully applying the correct mathematical value to plug into the algorithm.

**Digital Watermark**

A digital watermark identifies the intended recipient of digitized content, as well as its owner, using a sequence of numbers assigned by the vendor to a given purchaser. This numerical identity acts as a deterrent to illegal redistribu-
tion by enabling the owner of the content to track the content should unauthorized copies become available.

**High-Definition DVD**

The next generation of DVD players will have the capacity to display content in high-definition for over two hours per disc. High-definition video requires vast amounts of storage space with the amount varying as a function of compression ratio and video quality. The amount required for a movie can reach nearly 200 megabytes per minute. High-definition DVD (HD-DVD) players use lasers operating at a higher frequency, making it possible to decode more closely packed digital content. HD-DVDs use blue-colored laser beams operating with a wavelength of 405 nanometers instead of red ones that use 650 nanometers. By narrowing the beam used to decode content, engineers can expand the capacity of DVDs substantially from the current maximum capacity of 4.7 gigabytes of data.

Currently, consumer electronics manufacturers have yet to agree on a single HD-DVD format. The Blu-ray Disc, supported by nine major makers, including Sony, Panasonic, Philips, and Pioneer, can store up to 50 gigabytes of data, an amount that exceeds the data capacity of current DVDs by 600 percent. Blu-ray Disc recorders and players could offer backward compatibility with current generation DVDs, but the existing DVD players cannot display Blu-ray discs even at lower resolution. NEC and Toshiba have proposed a second blue-laser HD-DVD system called Advanced Optical Disc. This format offers 20 gigabyte capacity and the ability to retrofit existing players to operate in the new format.
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<td>Michael J. Wolf</td>
<td>McKinsey &amp; Company</td>
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The Museum of Television & Radio

The Museum of Television & Radio is the premier trust of television and radio’s heritage, and the world’s foremost institution dedicated to the preservation of the best of television and radio programming and advertising. Its collection of over 100,000 programs from more than seventy countries is a treasury of American and international cultural, political, and social history from 1918 to the present.

The Museum, founded by William S. Paley in New York City in 1975, opened a second facility in Los Angeles in 1996. Each year, over 200,000 visitors—including students, educators, and families—come to the Museum’s locations in New York City and Los Angeles to access programming and to participate in a broad range of educational and interpretive activities.

Its education program reaches over 40,000 students and family members annually, both on-site and through videoconferencing. Serving a range of students from elementary school through the university level, the education program fosters critical thinking through the interpretation and analysis of television and radio programs found in the Museum’s collection.

The Museum also serves as a neutral setting in which media professionals can examine the most pressing issues facing their industry. Through the programs of the MT&R Media Center and the International Council, the Museum is greatly enhancing its services to senior executives in a cross section of diverse yet increasingly converging communications industries.
With current efforts to augment its collection of international programs, develop innovative new initiatives, and foster partnerships around the world, the Museum is well positioned to expand the reach, scope, and content of the services it brings to the public and the industry.
Digital Rights Management (DRM)

Bibliography

Books


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DigitalConsumer.org (www.digitalconsumer.org)

Electronic Privacy Information Center (www.epic.org)

International Intellectual Property Alliance (www.iipa.com)

Motion Picture Association of America (www.mpaa.org)

Open Digital Rights Language Initiative (www.odrl.net)

Recording Industry Association of America (www.riaa.com)

Secure Digital Music Initiative (www.sdmi.org)

World Intellectual Property Association (www.wipo.int)