



Virtual Goods

# The Trajectory of DRM Technologies: Past, Present, and Future

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# Outline

- How DRM technologies developed
- Factors influencing their evolution
  - Lessig's 4 factors
- The current state
- Possibilities for the future

# How DRM Technologies Developed



# The Birth of DRM: Mid-1990s

- Conference: *Technological Strategies for Protecting Intellectual Property in the Networked Multimedia Environment*, late 1993, Washington DC
  - Sponsored by Coalition for Networked Information, Interactive Multimedia Association, MIT, and Harvard Kennedy School of Government
- White Paper: Mark Stefik, Xerox PARC, *Letting Loose the Light: Igniting Commerce in Electronic Publication*, 1994
  - Appears as chapter in *Internet Dreams*, MIT Press, 1996
- First important patent applications filed

# Early Technologies

## CD-ROM Protection (mid-90s)

- CD-MAX
- CrypKey
- InfoSafe
- TestDrive
- TTR

## 1996-1997

- DeskGate
- **Digital River**
- IBM Cryptolope
- EPR/InterTrust DigiBox
- Liquid Audio
- ZipLock (Portland Software)

# Early Technologies

1998

- DMOD
- **FileOpen**
- Greenleaf
- MediaDNA
- NetQuartz
- Phocis
- Preview Systems
- RightsMarket (TragoesS)
- Softlock
- ViaTech

1999

- Alchemedia
- **Authentica (now EMC)**
- ContentGuard (Xerox)
- **Infraworks (now Liquid Machines)**
- NetActive
- Perimele
- PublishOne
- **SDC (now Packet Video)**
- VYou



# How Were These Sold?

- Legal dept: Make the Internet safe for your content
  - Print documents -> protected PDFs
  - CDs -> digital music files
- Marketing: Enable new business models for content
  - Pay per view
  - Subscription
  - Site licenses

# What Happened?

- Bubble burst
- Content owners would not pay, and/or vendors charged too much
- Business models were not developed or marketed
- DRM became subsidiary to platform control (formats, codecs, players)



# Second Bubble ca. 2005: Mobile

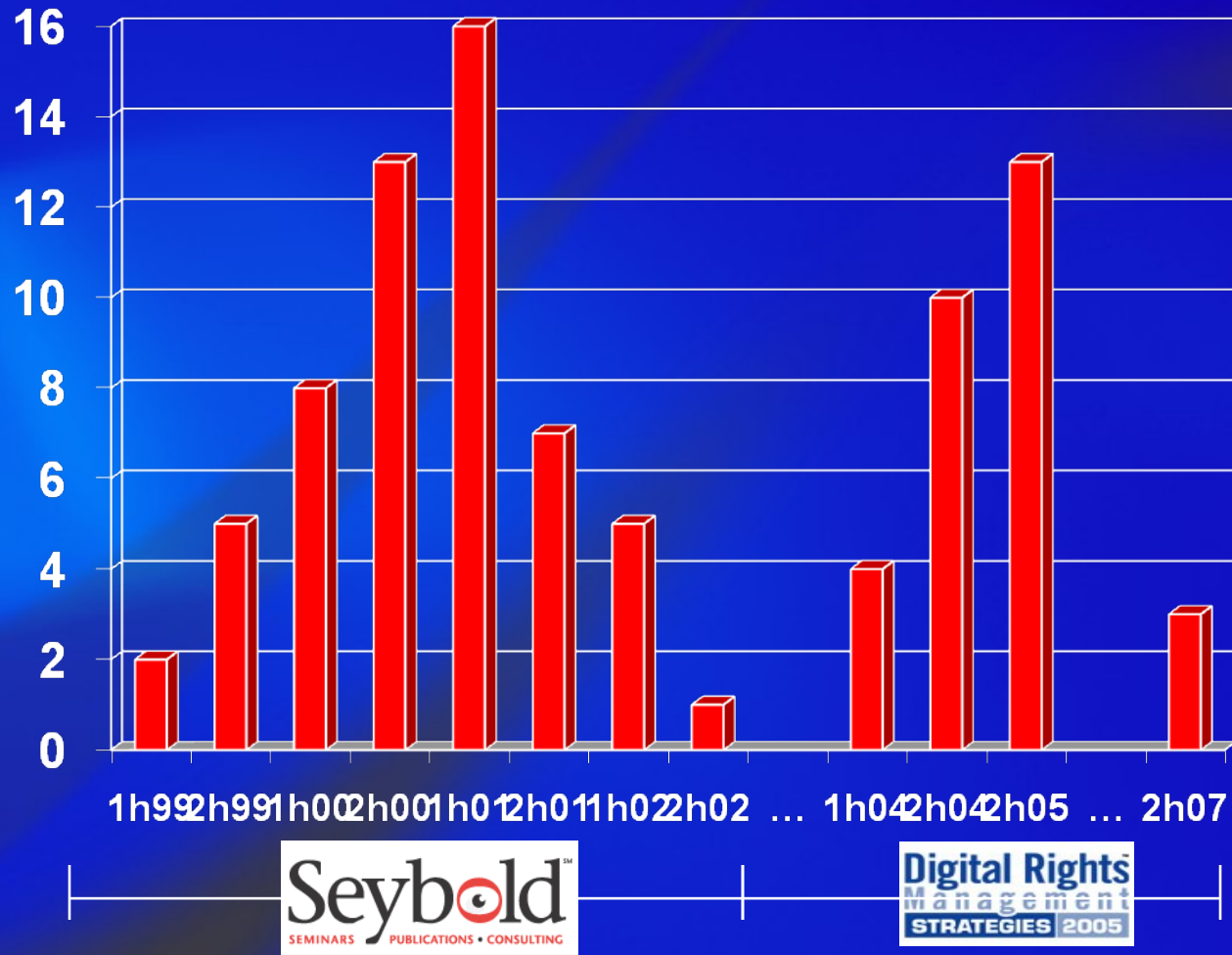
## OMA DRM

- CoreMedia
- Viaccess
- Beep Science
- Lockstream/Irdeto
- Access
- NDS
- Discretix
- Etc.

## Others

- SDC
- Melodeo
- Teruten
- INKA (Netsync)

# A Pseudo-Scientific DRM Market Barometer: Vendors on Trade Show Floors



# The DRM Scene Today: Music

- Internet: DRM confined to subscription services
  - E.g. Napster, Rhapsody
  - DRMs: mostly Microsoft WM DRM 10/11
- Mobile: various DRM-based models
  - Device/music bundles: Nokia Comes With Music, Sony Ericsson PlayNow Plus
  - Subscription models
  - Paid downloads
  - DRMs: OMA DRM, Microsoft WM DRM, Microsoft PlayReady, SDC

# The DRM Scene Today: Video

- Internet: download and rental services
  - Apple iTunes: FairPlay
  - Blockbuster, CinemaNow, others: WM DRM
- Mobile: digital broadcast, WiFi
  - OMA BCAST Profile

# The DRM Scene Today: E-Books

## ➤ Amazon

- Mobipocket DRM
- Kindle, iPhone, other portables

## ➤ EReader

- Partnership with Barnes & Noble, #1 US book retailer
- Proprietary DRM
- PC, Mac, iPhone, other portables

## ➤ Adobe

- Sony, IREX, Plastic Logic, other e-book devices
- Content Server DRM
- PC, Mac, iPhone

# The DRM Scene Today: Enterprise

- Corporate/institutional applications
- Became a distinct subfield in ~2003
- Now considered part of Content Management market
- Leading vendors:
  - Microsoft & partners
  - EMC (Authentica)
  - Oracle (SealedMedia)
  - Adobe



# Pioneering DRMs that Didn't Survive

- Intertrust
  - Digibox/InterRightsPoint
  - RightsSystem
- IBM
  - infoMarket
  - EMMS

# Larry Lessig's Four Factors\*

- Architecture (technology)
- Norms (behaviors)
- Law
- Market (economics)

\**Code and Other Laws of Cyberspace*, 1999, pp. 88-90



# Architecture

## Technology Enablers

- File encryption
- Network connectivity & bandwidth
- License management
- Rule specifications & RELs

## Criteria

- Ease of use
- Maintenance of user rights & expectations
- Security effectiveness
- Low support costs

# Norms

## Sources of Norms

- Popular online tool usage patterns
- Trust
- Opinions of thought leaders
- Motivations of hackers

## Criteria

- Necessity of DRM in the first place
- Height of barriers

# Law

## Laws

- Copyright infringement liability
- Content usage rights
- Anticircumvention

## Criteria

- Technological implementability
- User comprehensibility
- Balance of burden
- Effect on legitimate uses of technology and innovation

# Market

## Economic Factors

- Compensation for content creators
- Investment in technology development and R&D
- Consumer value and choice
- The pull of free

## Criteria

- Alignment of economic incentives
- Maximization of value to consumer through alternative offers
- Maximization of value to publisher despite alternative sources



# Factors Against DRM Success

## ➤ Market:

- Economic incentives misaligned

## ➤ Norms:

- Users don't see value in choices of offers
- Norms distorted by architecture (technology)

## ➤ Architecture:

- Technological innovation hampered

## ➤ Laws:

- Laws not amenable to technological implementation

# Economic Incentives Misaligned

- Content owners demand it but will not pay for it
  - Despite high expenditures on “anti-piracy services”
  - Claim that content protection is responsibility of technology vendors who want to offer access to their content
- CE vendors use it to suit their own purposes
  - Platform lock-in
- Consumers have no direct say in deliberations
  - Only indirect market forces
- In the end, music companies got what they paid for

# Consumers Don't See Value in Choices of Offers

- Expensive to educate consumers about unfamiliar offerings
  - Apple had huge marketing budget to educate about unbundled albums
  - But Rhapsody, Napster, etc. didn't educate sufficiently about subscription services
- Focus is on getting rights equivalent to offline content
  - Perception: pay == ownership && free == radio; therefore the only improvement is free == ownership

# Users Influenced towards Infringing Behavior

- Definition of DRM commandeered by the press
  - Narrower than original definitions
  - Yet broadened to apply to any technology that restricts user behavior in any way
- Notion that DRM == Big Media == evil
- Romanticism & rationalization of hacker/pirate ethic

# Technological Innovation Hampered

- Lack of revenue for DRM vendors
- Venture capital scared off
  - Bad press
  - Non-sexy topic
- Researchers scared off
  - RIAA actions against Prof. Ed Felten in 1999
  - DRM research “politically incorrect” in US



# Laws Not Amenable to Technological Implementation

- Fair Use/Fair Dealing laws notoriously hard to automate
  - EU Private Copying less so
- Privacy and due process are important but become obstacles
  - French Loi HADOPI
- Anticircumvention laws reduce incentive to develop effective technologies
  - 1993-6 accommodation between content and telecoms industries
  - WIPO Copyright Treaty, EU Copyright Directive, US DMCA
  - Liability solely on the hacker
  - Important US appeals court case: Universal v. Reimerdes, 2000



# A Few Success Stories

## Apple FairPlay

- “Cheap and dirty” DRM
- Component in first successful digital music application
- Educated consumers about unbundling of albums
- Tightly tied to hardware and software, no boundary glitches
- Lesson:  
Hardware vendor discovers how to benefit from DRM

## Pay TV Digital CAS

- Cable operators want to protect signals from theft
- “Walled garden” systems (no PCs)
- Limited alternatives
- Lesson:  
Alignment of economic incentives

# A Few Success Stories

## OverDrive E-Book Lending

- Adobe Content Server supports e-book lending
- E-Book lending expands power of library services despite lack of marketing ability
- Small market well served by single vendor, encourages efficiency
- Lesson: True expansion of consumer choices through DRM

## AACS (Blu-ray)

- Designed to address problems with CSS for DVDs
- Costlier DRM in costlier product
- Graceful hack recovery
- Impact of hacks overstated in press
- DVD industry forced to improve functionality
- Lesson: Better DRM costs more money

# Status of Rights Technologies Today

- File encryption
- License management
- Rule specifications & RELs

# Encryption

- Crypto algorithms were never an issue
- Cost is the issue
  - Key management schemes
  - Hardware vs. software key storage
- Software key management has gotten better
  - Graceful failure e.g. AACCS

# License Management

- Flexibility, yes
- Transparency, no

# Rights Specifications/REs

- Technology applicable outside of encryption
- Complex starting point was probably necessary
  - Emulate offline/legacy licensing models
- But didn't work
  - XrML designed by engineers for engineers
- Market needed time to find opportunities for simplicity
  - Remember ICE? Me neither.
  - Remember RSS? Of course.



# Future Possibilities



# Grow from Simplicity

- Emulation of legacy models is doomed to failure
  - Consumer expectations
  - Technological complexity
  - Misaligned economics
- New business models based on simpler technology can succeed
  - Create models to fit new opportunities
  - Build complexity from the ground up instead

# UGC Will Lead the Way

- YouTube, DailyMotion, Flickr, Scribd, MySpace are the 0.X models
- Volume dwarfs that of commercial content
- UGC needs rights management too
- Exposure is important, but so are monetization and use tracking
- “Profit from abundance” is not inconsistent with rights management
- Ultimately, “commercial content” = “marketing investment”

# Bet on These Technologies

- Rights languages
- Content identification
- Connected devices and streaming

# Rights Languages

## ➤ Creative Commons

- When services use it to make money, it's no longer a “religion”
- Note how “free” became “open source”
- Commercial content owners beginning to look at it seriously

## ➤ ODRL

- Moving beyond encryption applications
- Making all the right moves: subsetting, PLUS, CC

# Content Identification

## Fingerprinting

- Easy to implement now
- Works with content “as is”
- Difficult at the ISP level
- Poor integration with rights languages
- Not much benefit from standardization
- Too many vendors, market ripe for consolidation

## Watermarking

- Requires “connecting the dots”
- Requires insertion
- Easier at the ISP level
- Good integration with rights languages
- Would benefit greatly from standardization
- Market has already consolidated



# Connected Devices and Streaming

- License management becomes much easier
  - No slave device transfer issues
- Encryption becomes less disruptive
- Consumer expectations shift away from ownership
  - Services no longer devolve to “MP3 delivery” model

# Will Classic DRM Survive?

- Yes, where it supports new content models
  - Subscription
  - Personal network boundary setting
  - Hardware or service provider boundary setting

# Thank You!

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