

Flexibility as an Instrument in Digital Rights Management

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Introduction

- digital goods (audio, video, software, etc.) promise transferability and portability across various media and devices
- flexibility is often an essential aspect of consumer valuation
- flexibility carries risk of circulation of unlicensed copies
 - undermine revenue generating sales

Digital Rights Management

- DRM controls how consumers can use the good
 - how long customer can use the good
 - how often she can use it
 - how many devices she can use it simultaneously
 - how to copy and alter it
- DRM: response by content providers to increase users' valuation without risking additional sales

Greynet, Security and Platform

- Internet is “greynet” without perfect security provisions
- challenge: how to design and sell without complete security provisions
- likelihood to receive unlicensed copy is increasing
 - in number of licensed copies, in permitted flexibility
- trusted platform: hardware-based, cryptographic support for proof that receiver’s machine is running approved software stack

Flexibility and iTunes

- iTunes DRM rules
 - each music file can be played on five devices authorized by the buyer of the file
 - individual files can be burned on CDs without restriction, but every playlist, i.e. specific arrangement of several files, can only be burned seven times
- high quality files bought from Apple and those extracted from a user's own CDs using the iTunes software can be played by an iPod.

Platform and iPod - iTunes

- trusted platform: hardware-based, cryptographic support for proof that receiver's machine is running approved software stack
- digital good runs on platform:
 - enhances the security of DRM system
 - restricts use of unlicensed copies

Complementary Products

- digital good and platform are complementary products
- conflict between platform and content provider:

“Our music is not something to be given away to sell iPods.”

Music Executive, Financial Times, 3/04

1. Model

2. Optimal Flexibility and the Greynet

- Identical Customers
- Heterogeneous Customers

3. Platform and Content Offered by Single Firm

- Constrained Efficient Solution

4. Platform and Content Offered by Distinct Firms

- Inefficient, yet Superior to Pure Content Provision

Model

- continuum of consumers
- flexibility in use of digital good: $\lambda \in [0, \bar{\lambda}]$
- utility of consumer i for digital good:

$$\theta_i u(\lambda) - p$$

- willingness to pay θ_i
- u increasing and concave

Choices

- seller offers price for digital good p
- seller offers flexibility λ
- number of sold licenses q
- marginal cost of digital good $c = 0$
 - \Rightarrow efficient solution $\lambda = \bar{\lambda}$

Greynet

- digital good can be obtained through two channels:
 - *licensed product purchased at price p*
 - *unlicensed copy received with probability $\alpha q \lambda$*
- probability of receiving unlicensed copy proportional to:
 - sold licenses q , flexibility λ , contact rate α
 - α represent permeability of the content-distribution environment

Permeability and Contact Rate

- α influenced by technical and economic factors
 - more lenient copyright law,
 - less vigilant enforcement of existing copyright law,
 - more easily circumventable DRM,
 - higher Internet bandwidth and contact frequency
 - * college students vs senior citizens
 - * different access to a variety of sharing technologies

Identical Customers

- willingness to pay: $\theta_i = \theta > 0$ for all i
- equilibrium segmentation
 - some buy digital good
 - some get digital good

Market Equilibrium

- value of licensed copy:

$$\theta u(\lambda) - p$$

- (expected) value of unlicensed copy with flexibility λ_c

$$\alpha \lambda q \theta u(\lambda_c)$$

- identical consumers, indifferent across alternatives:

$$\theta u(\lambda) - p = \alpha \lambda q \cdot \theta u(\lambda_c)$$

Equilibrium Pricing

- increased circulation of copies through
 - higher flexibility λ , higher sales volume q
- critical level of contact rate α^*

Proposition (Pricing with Identical Customers)

1. For $\alpha \leq \alpha^*$, all customers buy the product and price p^* and flexibility λ^* are decreasing in α .
2. For $\alpha > \alpha^*$, the number q^* of paying customers is decreasing in α and p^* and λ^* stay constant.

Differentiated Customers

- willingness to pay: $\theta_i \sim F(\cdot)$
- gross utility: $\theta_i u(\lambda)$
- market segmentation with critical customer θ^*
 - high willingness to pay $\theta \geq \theta^*$: purchase licensed copies
 - low willingness to pay $\theta < \theta^*$: wait for unlicensed copies

Proposition (Pricing with Differentiated Customers)

The equilibrium price p^* , flexibility λ^* , and sales q^* are decreasing in α .

- market for sales becomes smaller
- increasing focus on high end customers
- yet quality of product offered decreases with increase in piracy
- socially inefficient allocation

Platform

- provision of platform to use digital good
- platform enhances security
 - digital goods can transferred but only on the platform
 - additional features
- complementary products, separate pricing
 - final utility from joint consumption

Integrated Provider

- price of software, hardware: p_s^I, p_h^I, λ^I

- market segmentation:

- hardware and software

$$\theta_i u(\lambda) - p_s - p_h$$

- only hardware

$$\alpha \lambda q_s \theta_i u(\lambda) - p_h$$

- neither

Proposition (Integrated Platform)

In an integrated platform market:

1. $\lambda^I > \lambda^*$;

2. $\theta^I < \theta^*$;

3. $p_s^I < p_s^*$.

- with a platform:

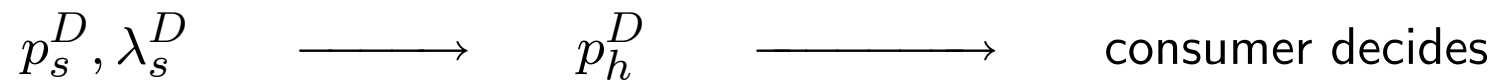
- flexibility is higher

- market for software (and hardware) is larger than in pure digital goods market

Distinct Providers

- denote equilibrium choices by $p_s^D, p_h^D, \lambda^D, \dots$

- timing:



- aspects of double marginalization:

- not quite...
- content and platform provider have different market size

Proposition (Complementary Products)

In the platform/content market equilibrium:

1. $\lambda^I > \lambda^D$;

2. $\theta^I < \theta^D$;

3. $p_s^I < p_s^D, p_h^I > p_h^D$.

- with distinct providers:

- flexibility is lower

- market for software (and hardware) is smaller

Conclusion

- role of competing platforms in the context of DRM
- role of competing distribution channels for content
- more sophisticated pricing strategies:
 - monthly fees for limited/unlimited transactions
 - varying flexibility (nonlinear pricing)
- heterogeneous consumers with respect to contact rate α

Strategies for Complementary Products

- Gillette makes money by selling blades not razors
- Cellular phone companies signing up cell-phone subscribers rather than selling phones
- conflict between platform and content provider:

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Music Executive, Financial Times, 3/04

Literature

- Parker and Van Alstyne (2005)
 - pricing of complementary products in two-sided markets
 - * selling to software developers and end consumers
 - * selling to entertainment industry and households

- Sundararajan (2004)
 - role of digital management to restrict digital piracy in optimal pricing model.
 - piracy acts as a constraint on the pricing policy
 - no interaction between flexibility and the implicit cost of piracy in terms of foregone sales
- Park and Scotchmer (2004)
 - cost of circumvention affects pricing of digital goods

Platforms in Security Context

- Microsoft Trusted Computing Platform (“Palladium”)
 - “hack-proof” by authorizing hardware
 - MPEG4 provides “hooks” for technical protection system
- Intel introduced serial number on Pentium III chips
 - identify computers for watermarking, encryption