

Intellectual Property and Network Economics

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The Issue

- My lecture focuses on **Information Products**
- Examples include: Audio, Video, Printed Information, Computer Software
- Later, I will focus on **Digitally-stored Information** only
- Network externality: Using a piece of information by one consumer benefits other consumers
- Should our thinking of intellectual property be affected by “network consumers” of information?

- Old issue: Debates date back to the introduction of the photocopier machine and Compact Cassettes.
- During the later 1960s music publishers argued that they will go bankrupt if private recordings will be allowed
- During the early 1980s movie publishers argued that the introduction of VHS videotapes will end the movie industry
- All these statements proved to be **wrong**: Both music and movie publishers earn significant profits from sales of audio and video cassettes!

The “New” Issue

Publishers now argue:

1. Digital convergence and the wide use of the Internet will take away our business
2. Therefore, copyright laws and enforcement should be modified accordingly

My View on this “New” Issue

It is not clear that new copying technologies are conceptually different from old copying technologies (from IP point of view)

Complaints About New Technologies

Is this new? No, publishers and attorneys always complain about new technologies.

Shapiro and Varian [p.96]:

“Hollywood didn’t like the rental business...In the end...Hollywood made a lot of money off them.”

“...prerecorded video tapes have been its savior...The companies that recognized the implications of the new technologies succeeded beyond their wildest dreams.”

Advice to Publishers

1. Avoid spending money on litigation!
2. Instead, spend your resources on R&D to develop technologies that utilize the Internet to enhance your sales
3. Develop information products that people will want to buy rather than just copy. That is,
4. Segment the market between buyers and non-buying users

Remark: Anyway, market segmentation is the key pricing instrument to generate profit from selling information.

Outline of the Remainder of My Talk

1. Digital convergence: Definition
2. Classifications of copying patterns, quality, and Internet distribution channels
3. Models of copying of digitally stored and distributed information
4. Fighting piracy: A model of hardware taxation
5. Conflict of interest among artists, publishers, and lawyers

Digital Convergence

The process that we call “digital convergence” has two major characteristics:

Storage: Different types of *information* can be stored using the same media.

Distribution: The different types of *information* can all be distributed using the same channels.

Remark

Information should be interpreted in broadest sense:

1. “Printed” : Books, Journals, Reports, Newspapers, Learning material
2. Audio: Music, Learning, Performances
3. Video: Movies, Performances, Learning
4. Pictures
5. Computer Software

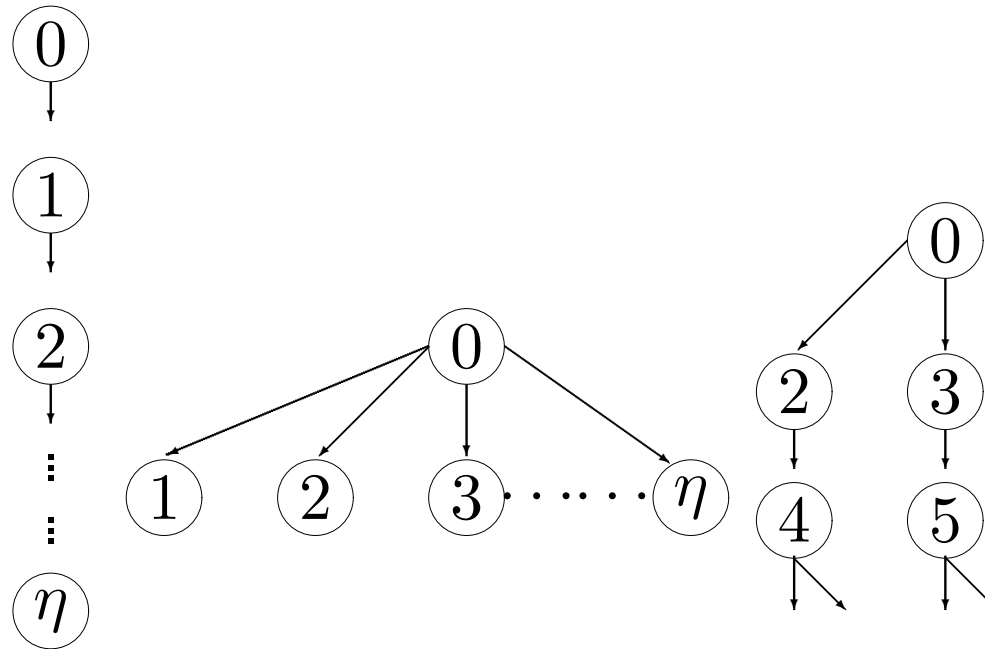
Key Observation

All the above can be **stored** and **distributed** using the same digital technologies:

1. Hard disks (storage)
2. CD, DVD, Removable Disks (storage and distribution)
3. via the Internet (distribution) and “soon”
4. Wireless (distribution)

This is what we mean by “digital convergence”

Classification of Copying Patterns



Vertical, Horizontal, and Mixed copying patterns

Discuss: Quality deterioration: Digital vs. non-digital copying

Digital versus Non-digital Copying

- Common statements made by publishers: “The change from analog to digital technologies will damage our profits”
- Why? Because digital information is easier to pirate. However, Shapiro and Varian [p.93]:

“The fact that a *perfect* digital copy can be made isn't that much scarier than the fact that a *very good* analog copy can be made.

Internet & P2P Distributions

2 types of Internet distribution channels: **Fixed sites** and **P2P**

(1) **Fixed Sites**: Products (software, information, music, etc.) are stored on servers. Users must access these sites in order to retrieve products (as sharewares or freeware).

How these sites are financed? (a) Could charge for downloading
(b) Utilize advertising (c) Engage in selling complementary products/services (e.g., hardware)

(2) **Peer-to-Peer & Gnutella**: An “arrangement” among users requiring the following steps:

1. Installation of special P2P software on a network-connected personal computer
2. Entering the IP address, thereby, immediately becoming a client and a server
3. All users utilizing this software share the entire list of IP addresses, so the community grows in high orders

Discuss: Napster & counter suit against CD publishers

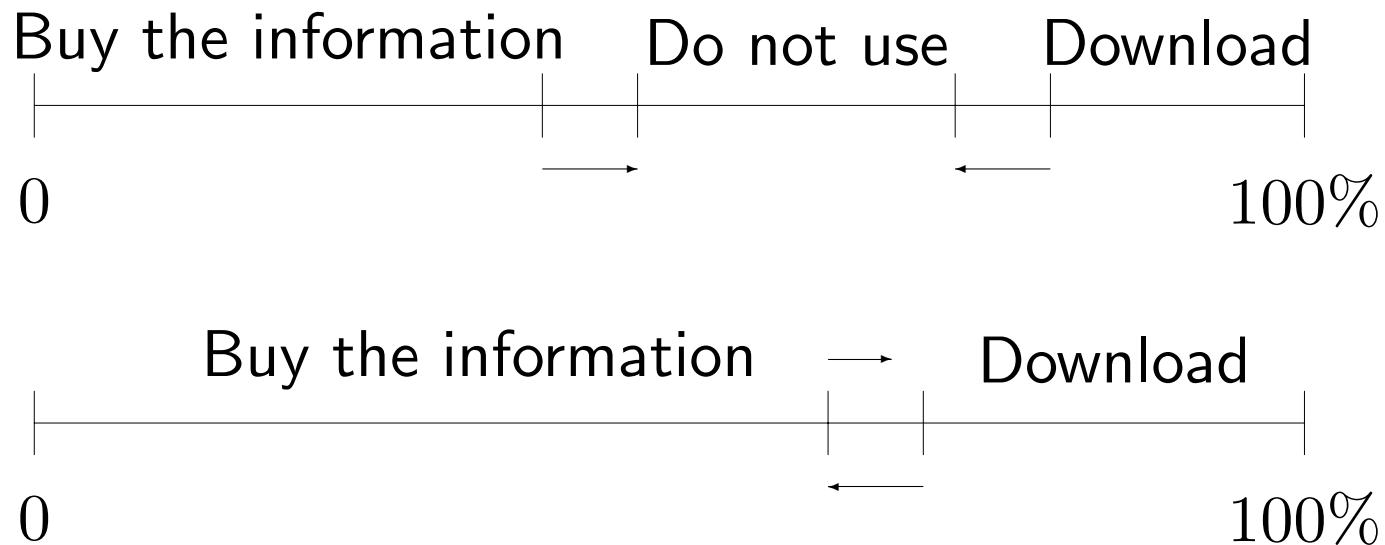
A Model of Peer-to-Peer (P2P) Distribution with Network Effects

- 2 Products: 'A' sold in stores, 'B' downloadable
- $n_A = \#$ buyers, $n_B = \#$ who download

In Gayer & Shy, *Economics Letters* 2003, we define $U_x \stackrel{\text{def}}{=} U_x$

$$\begin{cases} \alpha + \gamma_A n_B + \delta_A n_A - \tau x - p & \text{if buys product } A \text{ from a store} \\ \beta + \gamma_B n_A + \delta_B n_B - \tau(1 - x) & \text{if downloads } B \text{ from the Internet} \\ 0 & \text{Does not use this product.} \end{cases}$$

Two equilibrium configurations:



The effect of P2P on sales. Top: Partially-served market.

Bottom: Fully-served market.

Remark: Arrows indicate introduction of P2P.

Proposition 1. *As long as the market is only partially served, the publisher enhances sales and profits of product A by introducing product B over the Internet.*

Now, suppose that the market is **fully served**

Proposition 2. *The publisher enhances the profit from product A by introducing product B over the Internet, if the network size of B significantly benefits the buyers of A. Formally,*

$$\Delta\pi > 0 \quad \text{if} \quad \gamma_A > \frac{1}{2\tau} \left[\alpha \sqrt{\alpha^2 - 4\alpha\tau + 4\tau(\beta + \tau + \gamma_B)} + \alpha^2 + 2\tau(\beta - \alpha - \tau) \right].$$

Enforcement via Hardware Taxation

Taxing **Hardware**: Revenue proceeds are transferred to publishers (compensation for software piracy)

Gayer & Shy, *Information Economics & Policy*, 2003

We define users' utility by: $U_x \stackrel{\text{def}}{=}$

$$\begin{cases} \alpha x + \gamma N - p^h - p^s & \text{if buys hardware \& software} \\ \beta x + \gamma N - p^h & \text{if buys hardware \& pirates the software} \\ 0 & \text{if does not use software \& hardware.} \end{cases}$$

Hardware producers are taxed: $T = tN$ and given to information publishers

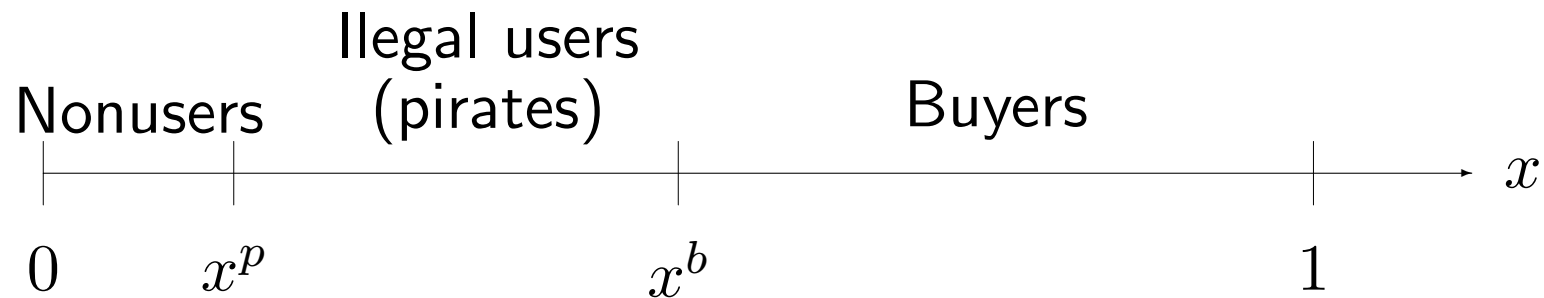


Figure 1: Nonusers, illegal users, and buyers.

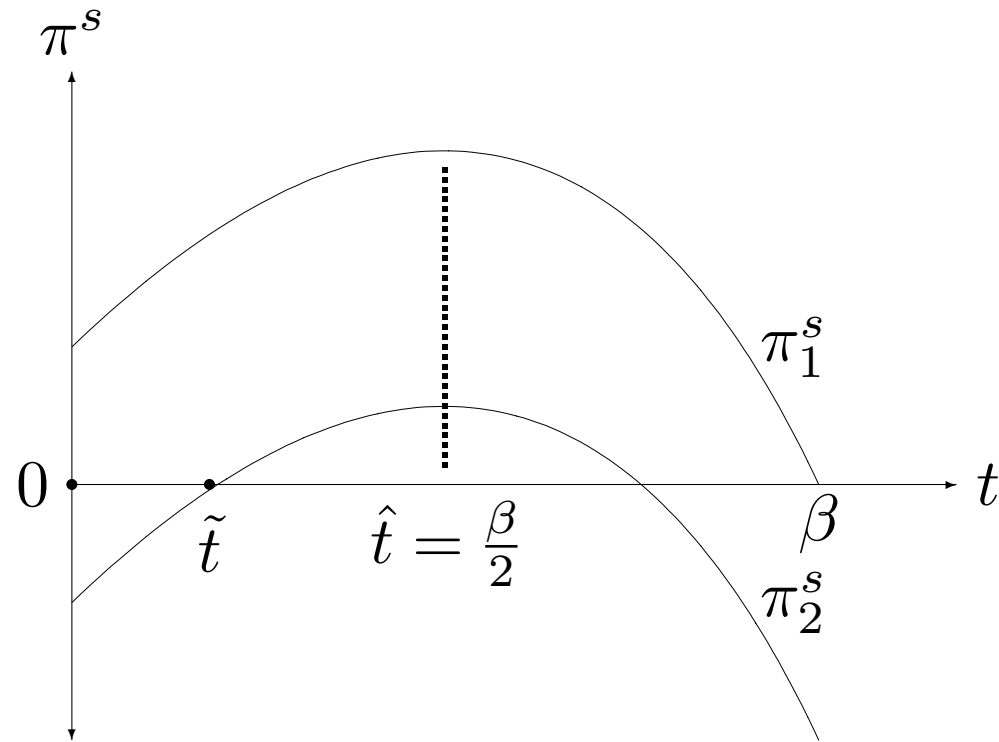


Figure 2: Software publisher's profit as a function of tax on hardware.

Proposition 3. 1. *By setting the hardware tax rate $t = \gamma\eta$, the government can eliminate piracy. However,*

2. *The hardware tax rate that maximizes the (tax inclusive) profit of the software developer is below the tax rate that eliminates piracy.*

Extreme Case: A high hardware tax may bankrupt the hardware industry, and hence the software industry

Extension to multiple software developers:

$$U_x = \alpha x + \gamma N - p^h - \sum_{s=1}^{\sigma} p^s$$

Conflicts of Interests

- Research on intellectual property and digital convergence always treats PUBLISHERS as a single entity
- This leads to strong conclusions about enforcement against violators of copyrights
- Reality: Artists gain profits from other sources (e.g., live and TV performances), and not only from recorded titles
- Reality: Lawyers always gain from litigation

Our Thesis: The following 3 agents

1. Artists (A) (creators of information)
2. Publishers (P) (say, recording studios and record companies)
3. Lawyers (L)

Have different and conflicting incentives to fight/endorse digital distribution technologies and piracy!

Notation: $n^b = \#$ buyers, $n^c = \#$ who copy,
 $n^\ell = \#$ who get sued, $\rho =$ royalty rate to artists

Case (a): Litigated Users Become Buyers

Artist's profit:

$$\pi^A = \rho p^P (n^b + n^\ell) + p^A \phi(n^b + n^c).$$

Publisher's profit:

$$\pi^P = (1 - \rho)p^P (n^b + n^\ell),$$

Result 1. *If every sued copying user becomes a buyer, then all the three agents (artists, publishers, and attorney) benefit from an increase in the number of law suits, n^ℓ .*

Case (b): Litigated Users Become Non-users Artist's profit:

$$\pi^A = \rho p^P n^b + p^A \phi(n^b + n^c - n^\ell)$$

Publisher's profit:

$$\pi^P = (1 - \rho)p^P n^b.$$

Result 2. *Suppose that copying users do not become buyers after being sued. Then, artists always lose from litigation, publishers are not affected, and only the attorneys continue benefiting from suing copying users.*