Copyright and DRM

Student Choice Topic

Notes for CSC 100 - The Beauty and Joy of Computing
The University of North Carolina at Greensboro

Copyright - More Legal Info

SOPA/PIPA - some additional concerns

- We talked about: requiring search engines to block "pirate" sites
- A web site operator could be found to "facilitate" copyright infringement if it hosts user-contributed infringing content
  - Remember secondary infringement from P2P cases?
  - Web 2.0: Users create/share content. Should the storage service be liable?
    - Google says 1 hour of video uploaded to YouTube *every second*
    - "Common carriers" - transport services that have some protection against transporting 3rd party content. A good thing for the Internet?
- Guilty until proven innocent?
  - Payment processors (like PayPal) and ad networks would have to set up notification process
  - Outside parties could notify and service would have to be cut off to the party within five days
  - Cut-off party presumed guilty and would have to prove innocence

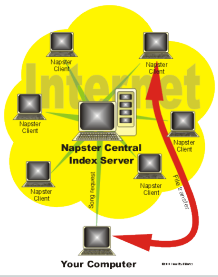
Current status: Tabled, to be taken back up later.

Peer to Peer Networks

What caused all the fuss?

It all started with Napster...

- Great overview at http://computer.howstuffworks.com/napster.htm

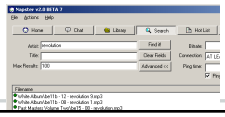


Actual copying is done person-to-person ("peers" with the same amount of power and Internet connectivity)

But: Wouldn't work without index server to find the content

- Recall Blown to Bits discussion on the power of search engines!

Napster search was really designed for sharing music:

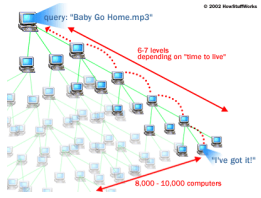


Peer to Peer Networks

If the index is a problem, make that peer-to-peer also

Gnutella

- Basic system from "Nullsoft"
- Various implementations: Limewire, Morpheus, Gnucleus, ...
- "How Stuff Works": http://computer.howstuffworks.com/file-sharing.htm



"Time to Live" is a well-known networking concept: Prevents loops on the Internet!

Exponentially expanding search area

Can share potential peer partners this way too, so no central service is needed.

Problem? Again, no secret what this was designed for...

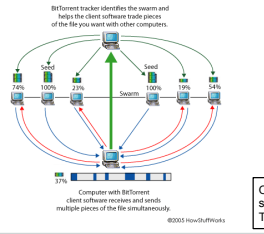
Contributory Infringement

Peer to Peer Networks

Latest in P2P Networks?

Currently most widespread: BitTorrent

- Technical problem with Gnutella: DSL/Cable modem upload rates are slow!
- Solution: Use many slow links in parallel
- "How Stuff Works": http://computer.howstuffworks.com/bittorrent.htm



"Seeds" provide the index to find content

Unlike previous networks, significant non-music/non-infringing use (many Linux distributions, etc.)

- No music-oriented search in BT

However, some sites specialize in seeds/magnet links for copyrighted material

- The Pirate Bay, etc.

Other "private P2P" technologies available to hide source IP: Freenet, I2P (Invisible Internet Project), Tor routing, …

Digital Rights Management

Controlling Access to Content

Idea: Content tagged with rules, and rendering software enforces

Examples:

- Only play once
- Play unlimited times, but only until Nov 20, 2012 at 10:00 AM
- Allow unlimited playing, but no copying
- Allow copying to up to 5 registered systems

Some difficulties for users:

- What if your computer with a 5000 song library dies? Backups are copies!
- What if company goes out of business, and software no longer updated for new operating systems?

Technical difficulties for DRM systems:

- Working off "snapshots" and/or virtual machines
- Using different (non enforcing) rendering software
- Grabbing from dummy device driver or audio monitor
- Grabbing from speakers/amplifier (the "analog hole")

Digital Rights Management

Some technical "big guns"

Stopping non-enforcing rendering software:

- Example: PDF viewers not enforcing access restrictions (no print, etc.)
- Software obfuscation: Make creating compatible software difficult
- Legal remedies: Anti-circumvention provisions of DMCA
- Using special hardware to lock content to a specific renderer/player
  - But: Can I fake the hardware through virtual machines?

Dummy device drivers and grabbing unencrypted digital stream

- Signed device drivers (allow "accept anyway"?)
- Trusted audio path: Digital content stays encrypted all the way to sound HW
- Protection-friendly video cards to stop "screen scraping"
- Can even extend through monitor/speaker connections for "analog hole"

Powerful technology: Trusted Computing

- Measures all HW/SW involved from initial boot sequence to renderer
- HW can restrict decryption to occur only in certain software environments
- Fairly complete protection against virtual machines, etc.

Digital Rights Management

Backlash and some overstepping by industry

Inconveniences that users have not accepted

- If awkward difficult to do what people want with content, they are more likely to seek unrestricted sources, even if illegal
- Almost all music purchases are now DRM-free

Some overstepping that led to backlash

- SDMI Watermarking challenge (2000)
  - Public challenge issued for people to try to break system
  - Challenge taken on and system broken by researchers at Princeton
  - SDMI then threatened to sue them if they presented their results
- Sony "rootkit" (2005)
  - A rootkit is software that stealthily changes your computer operation
  - Common among malware
  - Sony distributed CDs that autoran an installer that took over CD device driver and serveral other things
  - Rightly labeled as malware (malicious software) and removed from stores quickly

Some Other Interesting Stories

"Hacking the X-Box"

- Fascinating story of advanced HW/SW reverse engineering