

## Internet Economics

- **What does the internet facilitate?**
  - Huge numbers of users, customers
  - How can this scale?
  - Why was this big in 2000? Why is it big now?
- **Caveat Emptor: who is the buyer?**
  - How does traffic 'flow', what is a peering point?
  - Net-neutrality, Akamai, Joe the plumber
- **What about peer-to-peer networks?**

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10.1

## Bitcoin: Internet Economics?

- <http://www.weusecoins.com/>
  - What is the purpose?
  - Why is it free, open-source?
  - Who is using it?
- <http://bitcoinme.com>
  - Electronic money
  - Limited to 21 million?
  - What else?

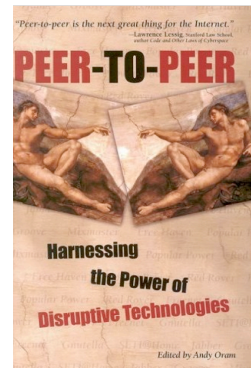


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10.2

## Peer to Peer

- **What is peer to peer?**
  - Useful? Disruptive?
  - Manageable, governable?
  - Architecture
- **Napster, Gnutella, Limewire, Kazaa, BitTorrent, Rapidshare, Usenet, Skype**
  - Which are p2p?



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## Characteristics of Peer-to-Peer (p2p)

- **Peers participate as equals in a network**
  - Unlike client-server model where there are different responsibilities: webserver compared to client-browser
- **Original Internet, Usenet**
  - Current Internet is more client-server
  - Usenet originally between Duke and UNC ('79)
- **P2P systems share resources, storage, files, bandwidth, ...**

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## P2P: Technology, Ethics, Policy, Legal

- Innocent Infringer, 17.504.c 2010
  - Maverick Recording v Whitney Harper
- RIAA v Limewire, 2010
  - Shut down Limewire
- MPA v Newzbin in UK, 2010
  - Shuts down Usenet 'integrator': financial so...
- Higher Education Opportunity Act 2008/10
  - Notice to Duke Students
- Capitol v (Jammie) Thomas
  - Jury trial, from \$2Million to \$25K ...



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## P2P: Technology, Ethics, Policy, Legal

- Capitol v (Jammie) Thomas
  - Jury trial, from \$2Million to \$25K ...
- MGM v Grokster, 2005 (scotus)
  - Non-infringing uses? Contributory
- A&M Records v Napster (2001)
  - Ninth Circuit: Contributory and Vicarious
- Sony v Universal Studios (Betamax, 1984)
  - Substantial non-infringing uses, time-shifting



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## Copyright infringement

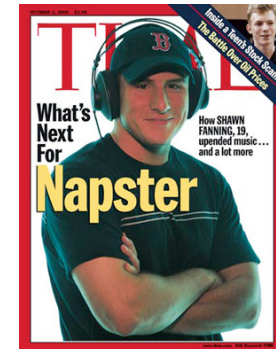
- Direct infringement
  - You uploaded, downloaded, copied, sang, ...
- Contributory (kind of indirect) infringement
  - Knowledge and participation (supply device)
- Vicarious (kind of indirect) infringement
  - Ability to control, financial benefit
- Proof, precedent, evidence
  - What have courts say, what can you show

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## Napster and Shawn Fanning

- Shawn Fanning
  - Napster, 1998-99
  - Centralized server, distributed "peers"
  - Under 20, mp3, ...
  - Still doing startups
- Napster started music peer-to-peer



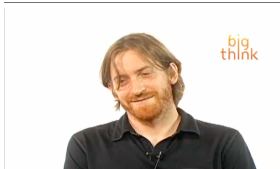
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## Gnutella and Justin Frankel

- **Winamp, 1998-99**

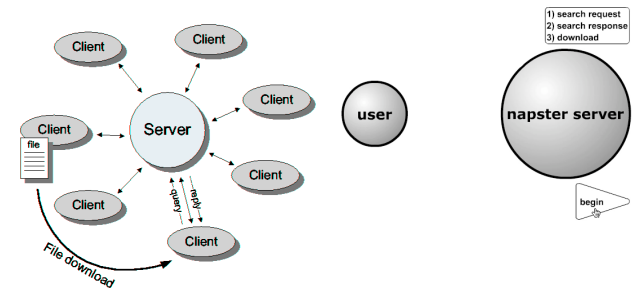
- Just 20, mp3+ others
- AOL, \$50+ million
- Gnutella, 2000
- AOL buying Gnutella



The goal of Cockos is to develop software sustainably while preventing profit rationale from forcing engineering compromises. By doing so, we can keep our product visions intact, giving maximum benefit to our users. (today) .

## Napster is Centralized p2p

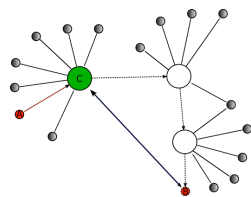
- **Legal ramifications?**



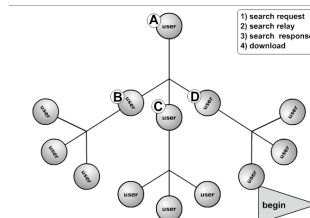
## Gnutella/Limewire decentralized p2p

- **Distributed**

- Bootstrap issues



→ Vendor Message  
 ..... Pong w/ DHT Support  
 ← DHT IPP Request UDP Ping/Pong



- **Started by Bram Cohen,**

<http://bitconjurer.org>

- Distributed p2p, torrent, tracker
- You must cooperate to download
- 20-30% of all Internet traffic

- **Files are split up and downloaded in pieces**

- Advantages? Disadvantages?
- **Seeder, swarm, clients**
- “optimistic unchoking” not tit-for-tat?



## Brian Fox

- GNU Bash Shell (developer)
- Buddycast (co-developer)
- “each person has a sweet spot — a place where they are incredibly productive and at their happiest while doing so — okorians spend their lives living there — the okori sweet spot is the realization of the concept, the delivery of the impossible, from the germ of the idea to the instantiation of it”

[http://www.theokorigroup.com/sweet\\_spot](http://www.theokorigroup.com/sweet_spot)

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## BitTorrent advantages?

TorrentFreak

Home

RIAA and MPAA Can't Stop BitTorrent, Study Finds

Written by Ernesto on October 14, 2009

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### Will Books Be Napsterized?

By RANDALL STROSS  
Published: October 3, 2009

YOU can buy “The Lost Symbol,” by Dan Brown, as an e-book for \$9.99 at [Amazon.com](http://Amazon.com).



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Or you can don a pirate's cap and snatch a free copy from another online user at RapidShare, Megaupload, Hotfile and other file-storage sites.

10.14

## Bittorrent meets DMCA and RIAA

- Indirect Swarm detection
  - In swarm? Liable
  - NAT, other IP address
  - “in-the-wild” experiment
- False positives
  - Direct harder
- Man-in-the-middle
  - No Encryption



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10.15

## Kazaa and Skype, Disruptive?

“Skype literally touches millions of lives and this is something to be proud of... I would like to think that we have contributed to making the world a little bit flatter.”



[www.crunchbase.com](http://www.crunchbase.com)

When Niklas is not creating innovative, disruptive businesses, he is a passionate sailor and enjoys offshore racing with his wife as well as skiing. (Niklas Zennstrom)

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## Costs of dealing with campus p2p

- The Campus Computing Project, Paul Green, 10/08
  - <http://tinyurl.com/5mqxyd>
- Private universities spend (average, '07-'08)
  - \$105K software, \$158K hardware, \$144K other direct costs (e.g., personnel)
  - Software for monitoring, shaping p2p
  - Hardware, e.g., Copsense appliance
  - Keeping up with RIAA: IT and student support

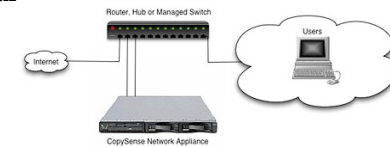
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## Audible Magic: Copsense Appliance

- EFF 'analysis' of solutions
  - <http://tinyurl.com/6l36p6>
- What does this do? Database of copyrighted works with digital fingerprints
  - Compare packet data with database
  - If there's a match do "something" to squelch use
  - \$60-75K/year

- Ethics?
- Tussles?



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10.18

## Packet shaping

- From \$1,500 to \$58,000 (Packeteer, there are others)
  - Look at where packets go, specific port
    - http: 80, limewire: 6346, Edonkey: 4662, ...
  - Look at what type of information packet carries
    - Typically don't need to do "deep" inspection
- Throughput, latency, throttling
  - Change network behavior



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## Deep Packet Inspection

- Comcast (2007) DPI to shape/deter p2p traffic
  - Look at packets and then deploy subterfuge
  - Forge RST (reset) packet, similar technique to what's done with Great Firewall of China
- Machine A "forges" a reset packet from machine B and sends to C. C then cuts off communication to B
  - Really? Is it that simple?
  - Violates end-to-end principle, havoc wreaking

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