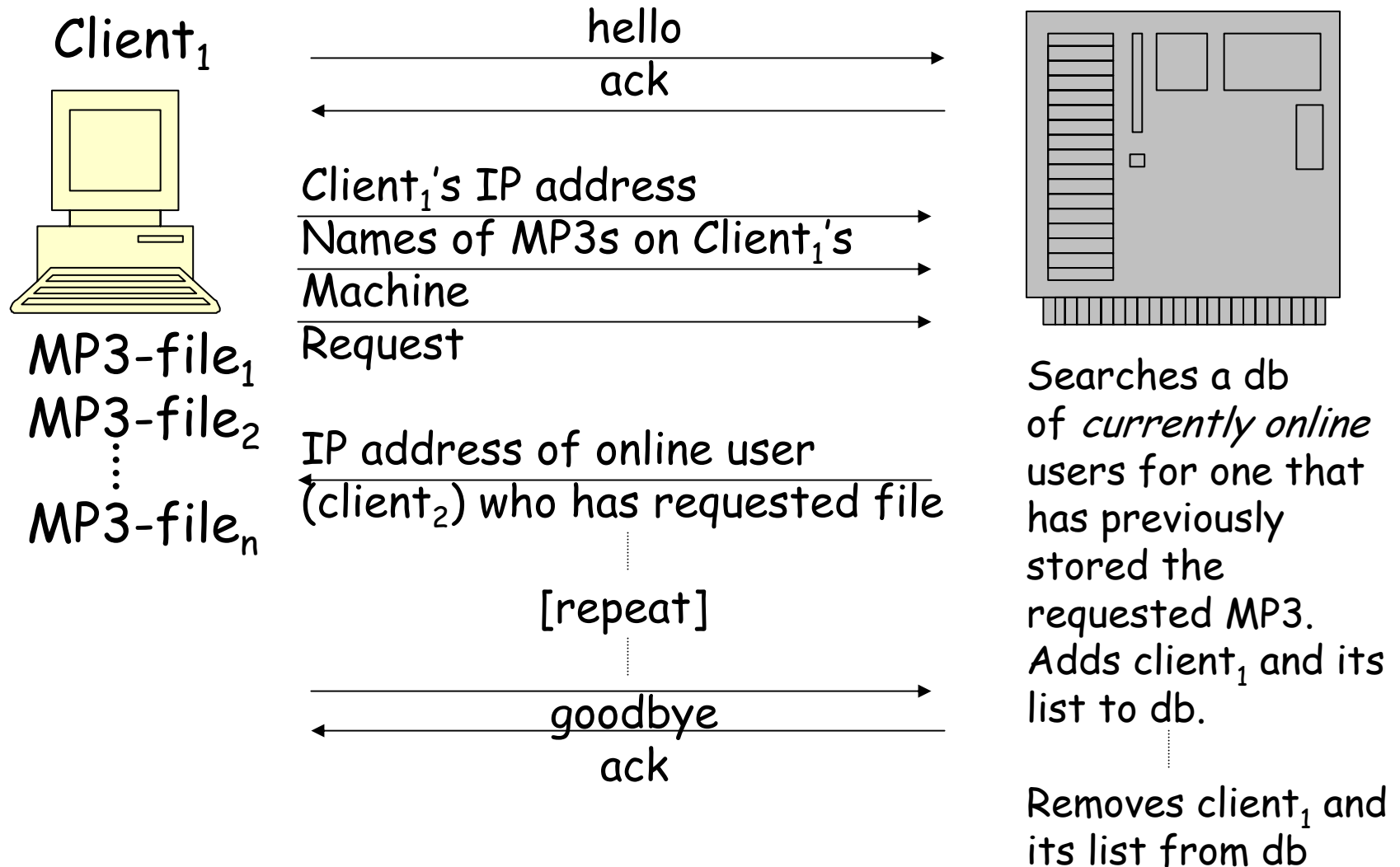


CPSC156a: The Internet Co-Evolution of Technology and Society

Lecture 14: October 28, 2003

Peer-to-Peer File Sharing

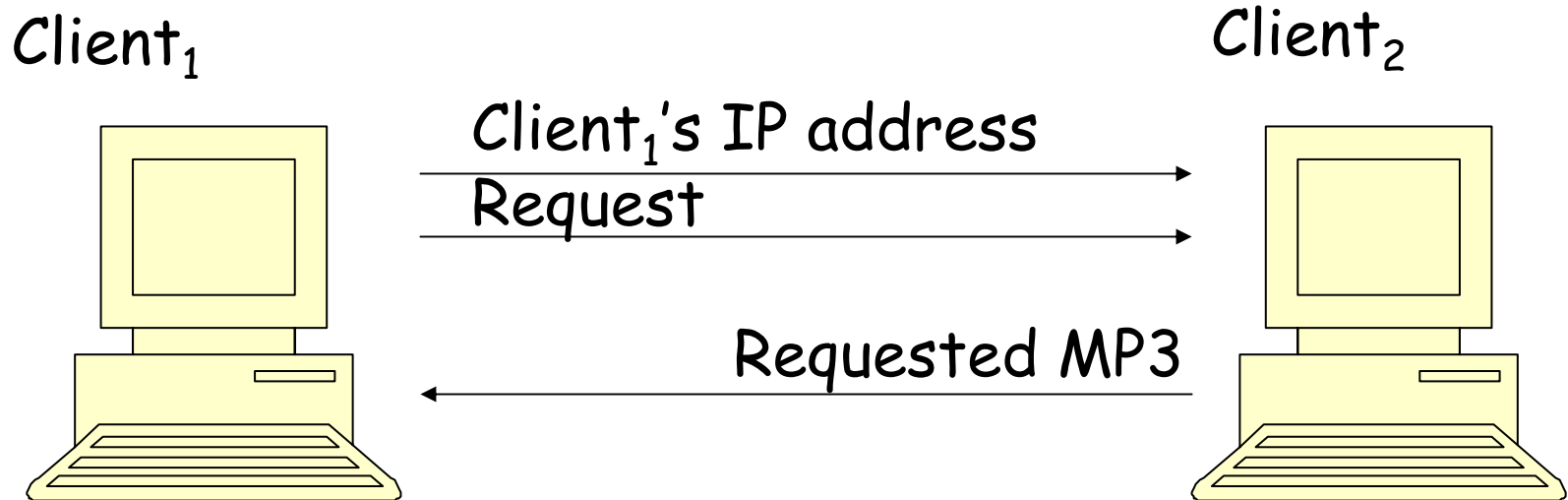
Napster Client-Server Interaction



Notes on Client-Server Interaction

- Proprietary protocol and db search.
- No MP3 files stored on server.
- Don't *need* usernames. Could have made the service anonymous.
- No need to save IP addresses between sessions. Many are assigned dynamically.
- Discussion point: Are anonymity and memorylessness threats or opportunities for business?

Napster Client-Client (P2P) Interaction



Note: This part uses "standard Internet protocols," *e.g.*, FTP

Napster History

- 1987: MP3 format developed by Karlheinz Brandenburg of Fraunhofer Gesellschaft. "CD ripping" now feasible.
- 1999: Shawn Fanning develops Napster, believing he has "bypassed" copyright law. Napster has >25M users in its first year.
- Dec., 1999: RIAA sues Napster for "contributory and vicarious" copyright infringement.
- April, 2000: Metallica sues Napster, Yale, Indiana Univ., and USC. (Yale bans the use of Napster within a week.)

Napster History, continued

- July, 2000: US District Judge Patel grants RIAA's request for an injunction. The injunction is temporarily stayed soon thereafter.
- October, 2000: Napster announces a partnership with Bertelsmann AG (one of the "major labels" in the industry whose trade association is suing it!).
- January, 2001: Napster and Bertelsmann say that they will roll out a "subscription service" by "early summer" and will use "DRM technology."

Napster History, continued

- February, 2001: Ninth Circuit upholds lower court's findings that Napster is guilty of contributory and vicarious infringement.
- Summer, 2001: Napster and Bertelsmann fail to roll out subscription service.
- September, 2001: Napster reaches a settlement with music publishers (but not with RIAA record labels). However, CNET.com reports the number of users has "dropped from tens of millions...to almost zero."

Napster, R.I.P. !

Gnutella P2P File Sharing

- "Pure Peer-to-Peer."
- Peers communicate over standard HTTP.
- Goal is "total decentralization." In particular, no Napster-like server that "directs traffic," collects data, and otherwise centralizes control.

"A" Generates a Gnutella Request

- Creates
 - Search String **S**
 - (Unique) Request ID **N**
 - Time-to-Live **T**
- Sends (**A**, **S**, **N**, **T**) to all of its Gnutella neighbors.

"B" Receives Gnutella Request (A, S, N, T)

- If B has already received request N or $T=0$, B drops this request and does nothing.
- B looks up S in its local file system and sends (N, Result) to A.
- B sends (B, S, N, $T-1$) to all of its Gnutella neighbors, and it records the fact that A has made the request N.
- When B receives a response of the form (N, Result) from one of its neighbors, it forwards this response to A.

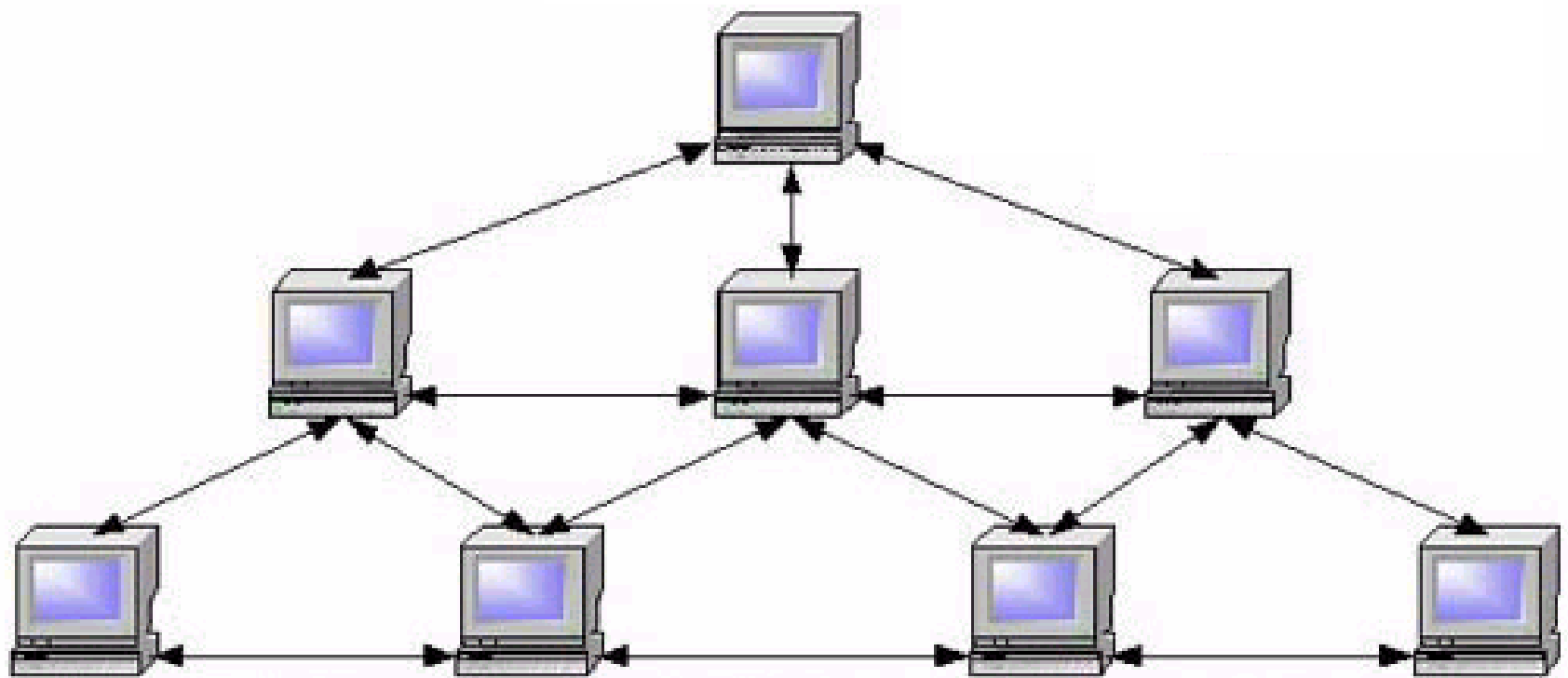
Gnutella Advantages and Disadvantages

Main Advantage : "Search for S" can be done in many ways, *e.g.*, structured database search, simple text matching, "fuzzy" text matching, etc. "Result" can take many forms.

Main Disadvantage : Inefficiency!

- "Flood" of Requests. If average number of neighbors is C and average TTL is D , each search can cause C^D request messages.
- Natural evolution into many barely-connected subnets, not one "user community."

Other Disadvantage : Request monitoring.
(Comes with standard HTTP.)



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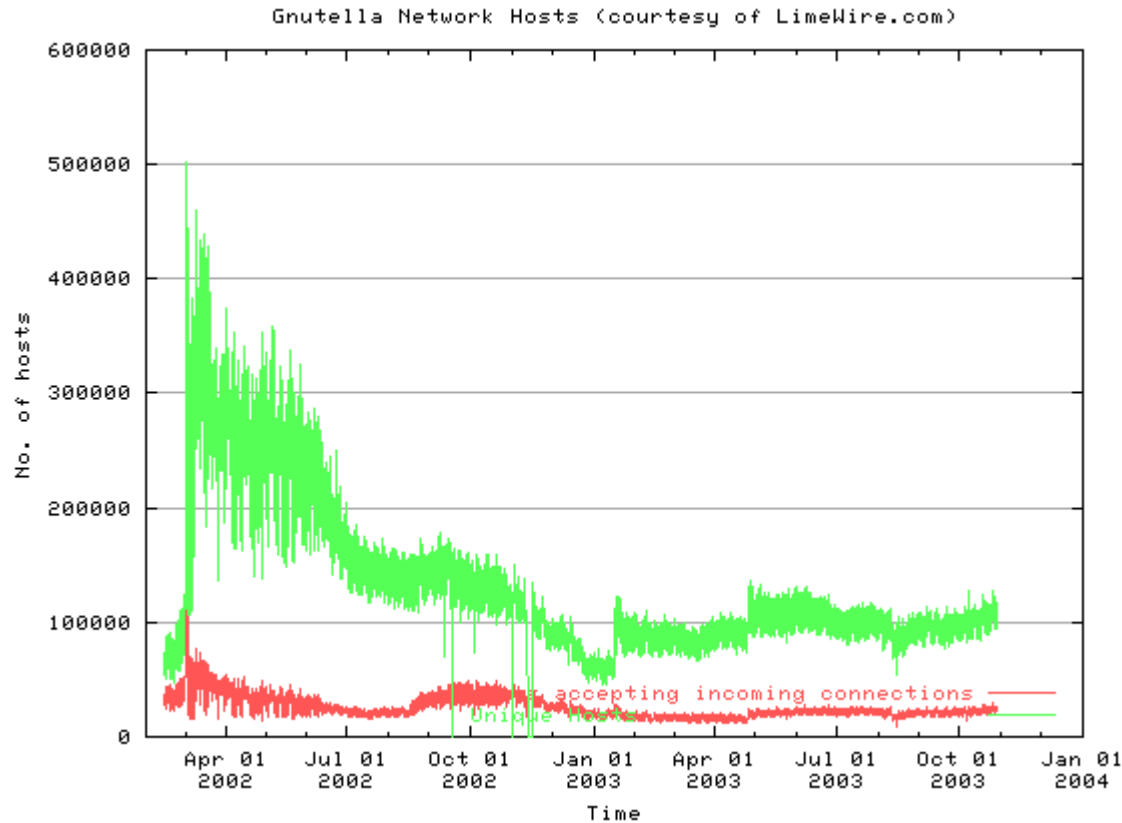
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Gnutella History

- Gnutella was written by Justin Frankel, the 21-year-old founder of Nullsoft.
- Nullsoft (maker of WinAmp) posted Gnutella on the Web, March 1999.
- Nullsoft acquired by AOL, June 1999.
- A day later AOL yanked Gnutella, at the bequest of Time Warner.
- People had already downloaded and shared the program.
- Gnutella continues today, run by independent programmers.

Number of Gnutella Hosts Over Time



Gnutella Clients

- LimeWire
- BearShare
- XoloX
- Morpheus
- Phex
- Shareaza

... and many others, developed by companies and individuals.



- LimeWire, LLC, is a wholly owned subsidiary of the Lime Group, a "technology incubator" that owns several small, "innovative" companies.
- LimeWire provides a Java-based Gnutella client. This allows the software to run on multiple platforms with a consistent interface.

LimeWire's Business Strategy

- Distribute its software as "the best file-sharing client available."
 - Take advantage of the Gnutella network (> 125000 hosts online simultaneously)
 - Improve and enhance interface
 - Reach more users by supporting multiple platforms
- Give away a free, ad-supported version; sell an ad-free, enhanced version for a small price.
- Charge companies for advertisements and provide partner links on website.

Kazaa

- Kazaa Media Desktop is produced by Sharman Networks, Ltd., “a consortium of private investors with multimedia interests” (see company website). Based in Australia with offices in Europe.
- Kazaa Media Desktop is a Windows file-sharing client available for free download. The application displays an ad banner.
- Recently released Kazaa Plus, which costs \$29.95. This version has enhanced search features and no advertisements.
- Design goal: Achieve Napster-like efficiency and avoid Napster-like liability.

Kazaa File Sharing

- Peers connect directly to each other; content is distributed and there is no central server.
- Search requests are sent to the "nearest" **supernode**, which tries to locate the content; if it fails, the request is sent to other supernodes.
- Any node running Kazaa with a good Internet connection can become a **supernode**.
 - Other Kazaa users upload lists of shared files to neighboring **supernodes**.
 - **Supernodes** facilitate search but do not host content; peers connect directly to download files.
 - **Supernode** status is controlled by the software based on user settings (permission to become a supernode, bandwidth restrictions, *etc.*).

Freenet P2P File Sharing

- Works similarly to Gnutella. Exceptions include:
 - Intermediaries store all results. (Diffuses responsibility.)
 - Uses proprietary protocol. (Eliminates HTTP monitorability.)
- Launched by Ian Clarke (Univ.of Edinburgh) in 1997.
- Explicitly anti-censorship, anti-copyright, and pro-anonymity in its goals.
- Less popular and less developed, although certain clients exist (see <http://freeweb.sourceforge.net> for a FreeNet 0.4 client).

Reading Assignment this Week

The following two sections of the Digital Dilemma report on technical-protection systems are required reading:

http://books.nap.edu/html/digital_dilemma/ch5.html

http://books.nap.edu/html/digital_dilemma/appE.html

The following two articles are optional:

["The Heavenly Jukebox"](#) by C. Mann and

["With Cable TV at MIT, Who Needs Napster?"](#)
by J. Schwartz.