

First and Second Generation Peer to Peer Networks

Napster and Gnutella

Smruti R. Sarangi

Department of Computer Science
Indian Institute of Technology
New Delhi, India

Outline

- 1 Napster
 - Protocol
 - Security and Piracy

- 2 Gnutella
 - Overview
 - Details

History of Napster

- The **mp3** format was the first widely used format for music files. A 5 min song required 5 MB of storage, which was pretty reasonable.
- Sites like mp3.com were the earliest mp3 sharing sites. However, most of the time links were broken.
- In 1999 Shawn Fanning observed:
 - Need a dedicated search engine to find mp3 files only.
 - The ability to trade mp3 files with other users.
 - Find and chat with other mp3 users online.

The provider needed:

- Napster installed on the computer.
- A shared directory

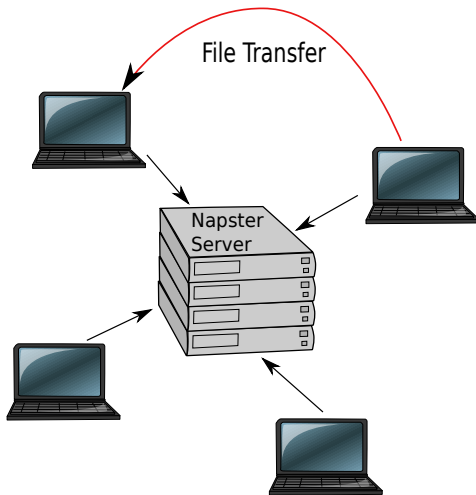
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Flow of Actions

- User opens the Napster utility.
- She logs on to the server.
- The server updates its database with the list of files in the shared directory.
- The client types a search term for a query.
- The server responds with the IP address of the machine containing the song.
- The client establishes a connection with the machine and gets the song.

Flow of Actions - II



Napster Protocol

- It is a client-server architecture.
- Server (**broker**) runs on port 8888 or 7777.
- A message to/from the server is of the form:
<length><type><data>

length Describes the length of the message (2 bytes).

type error/login/login ack/ version/upgrade

data The actual data.

Protocol Overview

- Allowed conversations among users by creating virtual chat rooms.
- All the traffic went through the central site.
- Napster mostly handled mp3 files. (Later support for .wma).
- Client sends a search request to the Napster site.
- The actual file transfer was direct between clients. The transfer did not go through the central site.

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Napster Security

- Hard for clients to lie – cannot give fake details such as IP addresses.
- Central site has all the control.
- Central site knows the details of every single transfer (**Privacy Issues**).

Piracy Issues

- Millions of people were freely sharing copyrighted songs.
- Free internet provided by universities was being abused.

Result

Napster was banned in most universities and public facilities.

- P2P file sharing did not stop.
- Protocols such as Gnutella got rid of the central server. This reduces the legal liability.
- Later protocols allowed the users to share **all types of files**

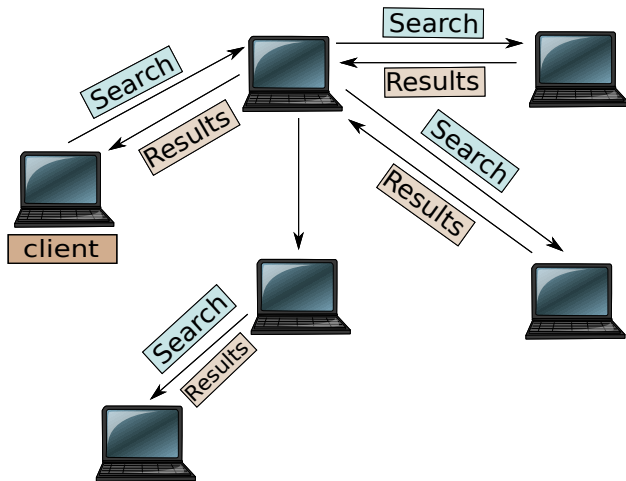
Gnutella

- **Gnutella** is a distributed network. It does not have a central server.
- A Gnutella host joins the network by first contacting another Gnutella host.
- It then sends file search messages to its neighbors, and the neighbors forward the message to other neighbors.
- A TTL (Time to Live) field ensures that the message dies out.
- Once a server replies, the client establishes a direct connection with it to download the file.

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Overview- II



Entities of each Gnutella Peer

Connection Handler

Manages connections with other Gnutella peers.

Co-ordination Instance

Co-ordinates connections with other Gnutella peers.

Download Instance

Handles a download from a remote peer.

Upload Instance

Uploads a file to a remote peer.

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Requests in the Gnutella Protocol

- Initially the connection handler is in the **offline** state.
- It opens a co-ordination connection with another Gnutella peer and sends a **CONNECT** message.
- The state changes to **online**.
- In the **online** state, the client might ping other peers to find the size of the Gnutella network (**ping** state).
- When the client wishes to search for an item, it enters the **search** state.
- A remote peer might reply with search results.
- If it is not behind a firewall, then the Gnutella protocol will start a connection to transfer the file.
- Otherwise, it will send a CLIENT-PUSH request.

Requests in the Gnutella Protocol- II

The co-ordination instance can receive 5 types of messages.

- 1 **ping**: The TTL will be decremented and the message will be forwarded to remote peers. The returning *pong* message will be sent back in the reverse order of peers to the client.
- 2 **pong**: Update local database with information about remote peers. Send the **pong** message back to the original client.
- 3 **search**: If the file exists locally, then return a **search result** message. Otherwise, decrement TTL and forward the message to peers.
- 4 **search-result**: Update the search results and try to download the file from the remote peer.
- 5 **client push**: Create a new connection to the remote peer, send the **giv** message, and transmit files through an upload instance.



Napster and Gnutella: a Comparison of two Popular Peer-to-Peer Protocols Anthony J. Howe and Mantis Cheng